AMERICAN JOURNAL OF ORTHODONTICS

OFFICIAL PUBLICATION OF
THE AMERICAN ASSOCIATION OF ORTHODONTISTS,
ITS COMPONENT SOCIETIES, AND
THE AMERICAN BOARD OF ORTHODONTICS

Editor-in-Chief

H. C. POLLOCK, ST. LOUIS, MO.

Assistant Editor

EARL E. SHEPARD, ST. LOUIS, MO.

Editor of Abstracts and Reviews

J. A. SALZMANN, NEW YORK, N. Y.

Sectional Editors

CHARLES R. BAKER, Evanston, Ill.
HENRY D. COSSITT, Toledo, Ohio
JOSEPH D. EBY, New York, N. Y.
WILLIAM E. FLESHER, Oklahoma City, Okla.
HENRY F. HOFFMAN, Denver, Colo.
STEPHEN C. HOPKINS, Washington, D. C.
JAMES D. McCOY, Beverly Hills, Calif.
OREN A. OLIVER, Nashville, Tenn.

PUBLISHED BY THE C. V. MOSBY COMPANY, ST. LOUIS 3, U. S. A.

TABLE OF CONTENTS ON PAGE 2

Copyright 1956 by The C. V. Mosby Company

Vol. 42 **FEBRUARY, 1956** **No. 2**

Whatever Your Needs. . .

1 Williams Round Buccal Tubes — for .036" or .040" diam. wire.

2 Williams No. 2 Arch Wire — for labial or lingual arches. Round (.036" to .040" diam.) or rectangular (.022" x .028").*

3 Williams No. 1 Ortho Wire — for intermaxillary hooks, adjustable spring stops, etc. (.020", .022", .036" or .040" diam. wire).*

4 Williams Anterior Bands — anatomically contoured — 18 graduated sizes, .004" x .160" wide.

5 Williams Open Bracket Tubes — for .032", .036", or .040" diam. wire.

6 Williams Stainless Steel Ligature Wire — .012" diam.

7 Williams Lok-Tite Wire — high bend test rating — .028" and .030" gages.

8 Williams Mershon Tubes and Posts — extra bearing surface for greater stability to lingual arch. (Also round and half-round tubes.*)

9 Williams Seamless Molar Bands — plain or contoured — 24 graduated sizes, .007" thick x .180" wide.

10 Williams Adjustaloop Contoured Bands — precise anatomical conformity — .036" to .485" diams.

11 Williams No. 1 Ortho Spring Wire — for stabilizers, auxiliary springs, etc. — .020" or .022" diam.*

12 Williams Arch Repair Tubes — slotted for quick, simple mending. In 4 sizes.

13 Williams Band Material — gages .009" to .003", widths .12" to .25".*

X Williams Ortho Wire Solder — gages .020" and .012" known for its ease of flow, strength, and absence of pitting.

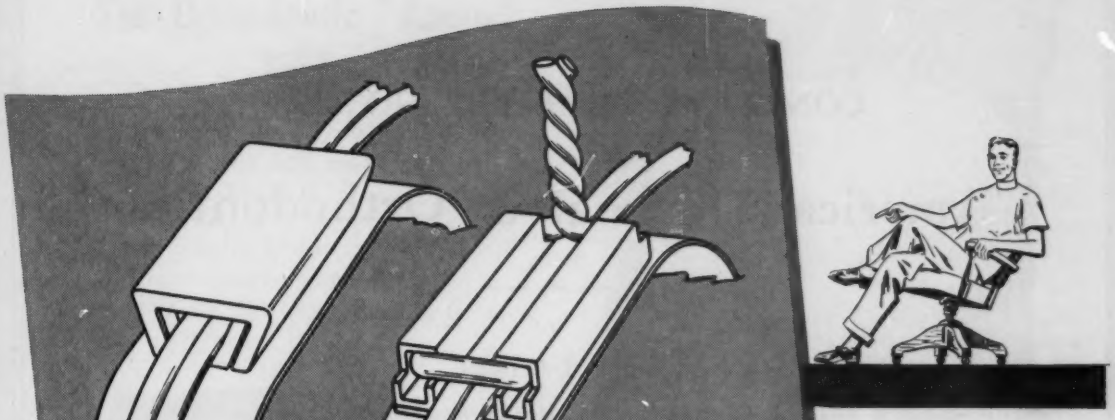
*Items indicated also available in stainless steel.

Above is only a partial listing of Williams Orthodontic Materials.
For helpful information on all items write for complete catalog and prices.

WILLIAMS Gold Refining Co., INC.

FORT ERIE, ONT. BUFFALO 14, N. Y. HAVANA, CUBA

Vol. 42, No. 2, February, 1956. American Journal of Orthodontics is published monthly by The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo. Subscription rates: United States and its Possessions $10.00, Students $5.00; Canada, Latin-America, and Spain $10.50, Students $5.50; Other Countries $11.00, Students $6.00. Single copies $1.75 postpaid. Entered as Second-class matter, January 14, 1915, at the Post Office at St. Louis, Missouri, under the Act of March 3, 1879. Printed in the U. S. A.



These are the BAKER STEEL LOCKS AND BANDS for the Johnson Twin Arch Technic

The new Baker tie brackets as well as the genuine Johnson locks for the twin arch technic are now also available in stainless steel.

All genuine Baker precious metal or steel caps will fit any genuine Johnson locks regardless of where your patients may go.

The Baker tie brackets are the same length as the Johnson locks. The ligature tightens over the end platforms leaving the arch to slide freely, avoiding any possibility of binding the arch to the tooth. They have a definite seat for the twin arch or the small Johnson ribbon arch, and will accept up to .022 x .028 edgewise wire perfectly.

Both are supplied mounted on the four sizes of .004 Johnson stainless steel pinch bands $\frac{3}{32}$″ or $\frac{1}{8}$″ widths, or on .003 or .004 gauge steel strip bands $\frac{3}{32}$″ or $\frac{1}{8}$″ wide, $1\frac{3}{4}$″ or 2″ lengths, or on welded loop and anterior bands.

★ ★ ★ ★ ★ ★ ★ ★

BAKER & CO., INC.

850 PASSAIC AVENUE • EAST NEWARK, NEW JERSEY

NEW YORK CITY 30 Church St. • **CHICAGO** 55 E. Washington Street • **SAN FRANCISCO** 760 Market Street

BAKER
THE WORLD'S LARGEST WORKERS AND REFINERS OF PRECIOUS METALS

CONTENTS FOR FEBRUARY, 1956

American Journal of Orthodontics

Original Articles

President's Address, Central Section of the American Association of Orthodontists. Howard Yost, D.D.S., F.A.C.D., Grand Island, Neb. 79

The Early Expansion of Deciduous Arches and Its Effect on the Developing Permanent Dentition. Richard E. Barnes, Ph.B., B.S., D.D.S., Cleveland, Ohio ---------- 83

Case Selection in Orthodontic Management During the Mixed Dentition Period. Waldo O. Urban, B.S., D.D.S., M.S., Evanston, Ill. -- 98

Diagnosis and Treatment With Occipital Anchorage. Walter H. Mosmann, D.D.S., Hackensack, N. J. ---------- 112

A Fifth Column Within Normal Dental Occlusions. Murray L. Ballard, D.D.S., Santa Rosa, Calif. ---------- 116

Influence of Heredity in the Etiology of Malocclusion. Kathryn F. Stein, Ph.D., Thomas J. Kelley, D.D.S., M.S., and Eunice Wood, M.A., Boston, Mass. ---------- 125

An Anatomic Anomaly of the Maxillary Labial Frenum. Robert E. Crowley, D.D.S., Montrose, N. Y. ---------- 142

Editorial

Occlusal Mannerisms and Relapse of Mandibular Incisors ---------- 150

Department of Orthodontic Abstracts and Reviews

Orthodontic Abstracts and Reviews ---------- 152

News and Notes

News and Notes ---------- 157

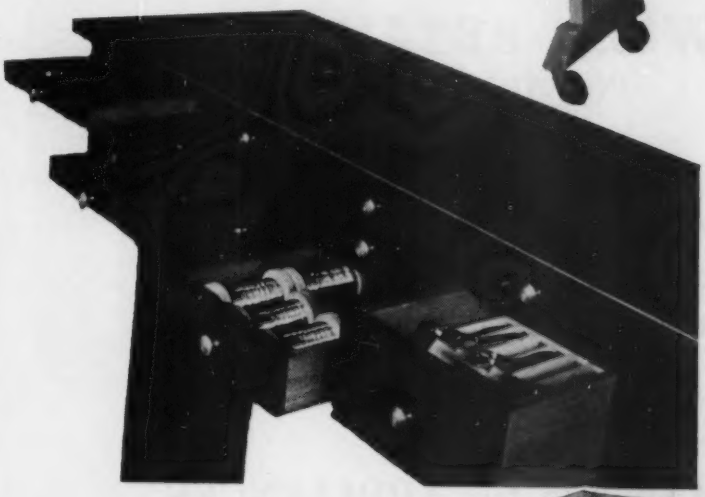
Officers of Orthodontic Societies

Officers of Orthodontic Societies ---------- 160

(Editorial and Business Communications on inside back cover)

The Orthodontic "Angle" Table

- Formica Working Surface
  - Alcohol and Acid proof
    - Heat Resistant
- Scientifically Constructed
  - Lower cross bar eliminated
    - Table may be moved close for comfort



Limed Oak or Walnut Finish.
$129.50
43" high x 40" long x 14" wide

- Ample drawer space 10 drawers to hold all your Instruments—Pliers—Wires—Cotton Rolls—Cements—and all other materials.

A Beautiful Record Model Cabinet

- Kiln Dried Oak with Limed Oak Finish — $42.50
- Sliding Glass Doors and Functional Mirror Back
- Complete with *3 Adjustable* Glass Shelves

30" High, 36" Long, 8" Deep

Wide enough to permit the original Record Models to be placed behind the finished Record Models. Cabinet holds up to seven shelves. Display Area —798 square inches

Additional glass shelves with brackets. $2.50

ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE—F.O.B. N. Y.

BETTA ORTHODONTIC SUPPLIES

123 WEST 64TH STREET · NEW YORK 23

"IF IT'S ORTHODONTIC . . . WE HAVE IT"

ORTHODONTIC SPECIALTIES LABORATORY

First in Modern Orthodontic Technique

invites you
to send your models and prescriptions
for our new unique

HAWLEY RETAINER

IN FLAT WIRE

•

This is a new specialty recently added to
our complete line which includes:

- **ORTHODONTIC APPLIANCES**
  in GOLD, STEEL, and ACRYLIC
- **ANATOMIC POSITIONERS**
- **MOUTHPIECES**
- **WHITMAN Elastic APPLIANCES**

All of these appliances reflect our use of the most technically advanced methods and ideas.

•

THIS IS YOUR LABORATORY . . .

- for extremely careful execution of that special idea or design
- for really custom-made appliances that are made to fit with minimum of time and effort on your part

We offer the advantage of prompt and dependable nationwide and world-wide service. Regardless of your location, you get immediate personalized attention. Our prompt delivery and mail order service is exceptional . . . and your time schedule is our guide.

Your questions and ideas stimulate us to greater effort. We invite and welcome them.

BOOKLET available on request

ORTHODONTIC SPECIALTIES LABORATORY
122 East 25th St., New York 10, N. Y.

new contemporary beauty in
unitek orthodontic spotwelders
to match your dental equipment

COLORS

* BISCAYNE BLUE

* JADE GREEN

* WASHINGTON CORAL

* ALL SPOTWELDER MODELS NOW AVAILABLE IN MATCHING DENTAL EQUIPMENT COLORS AT NO INCREASE IN PRICE.

completely restyled and
re-engineered for improved performance
and extended versatility

Unitek CORPORATION 275 NORTH HALSTEAD AVENUE • PASADENA, CALIFORNIA

PRODUCTS OF THE WELDMATIC DIVISION, PIONEER MANUFACTURERS OF PRECISION STORED-ENERGY WELDERS FOR ELECTRONICS, INSTRUMENT INDUSTRY AND ORTHODONTICS.

Paraphrasing a Biblical Quotation—

"WHAT PROFITETH IT A DENTIST WHO GAINS THE WHOLE OF SCIENTIFIC KNOWLEDGE BUT LOSES MONEY IN HIS PRACTICE?"

Practice Administration for The Dentist

Edited by

WILLIAM R. MANN, M.S., D.D.S., Ann Arbor, Mich., and **KENNETH A. EASLICK**, A.M., D.D.S., Ann Arbor, Mich.

386 pages **PRICE, $8.50**

This book provides a summary of the fundamentals necessary for the efficient, ethical practice of dentistry, for professional improvement, and for participation in community life—a long uncharted area of professional concern. It is the result of a workshop attended by dentists, dental hygienists, dental assistants, dental teachers, and others interested in this field. The purpose of the workshop was to appraise critically the present data, information and opinions available regarding the entire area of practice administration and to determine the best patterns for the dentist to adopt in organizing and administering his practice and for filling his niche of professional responsibility in his community.

It is just as important for the dental practitioner to understand the fundamental principles and procedures of good practice management as it is for him to be familiar with the best technics, and it is essential that he take advantage of every opportunity for learning and improvement in this phase of practice. This book covering the proper management of accounts, accurate record-keeping, cordial patient relationships, effective use of auxiliary personnel and equipment, and efficient financial policies contains the information needed to successfully cope with today's problems.

THE C. V. MOSBY COMPANY
3207 Washington Blvd.
St. Louis 3, Missouri

Date _____

Gentlemen: Send me a copy of Mann-Easlick
"PRACTICE ADMINISTRATION FOR THE DENTIST, " priced at $8.50.

____ Attached is my check ____ Charge my account.

Dr. _____ Street _____

City _____ Zone _____ State _____

AJO-256

The ORTHO Z NODIC Stainless Steel Bath

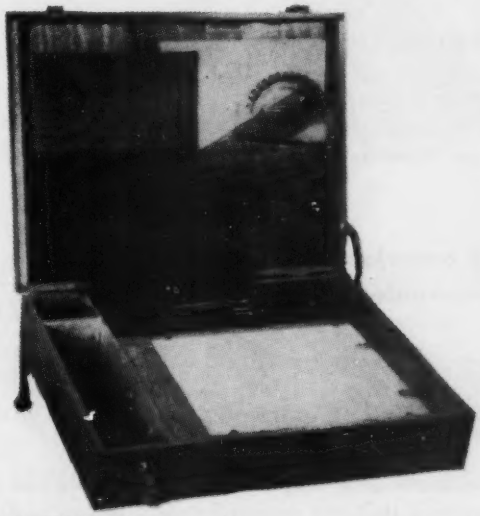
- AN EFFICIENT
- TROUBLE FREE*
- ELECTRONIC CLEANER
- ELECTRONIC REDUCER

Model BO-1-A	without timer	$69.50
Model BO-1-B	with timer as shown	$79.50

***4 Reasons For Its Trouble-Free Operation**

1. LEAD ACID PAN	Is guaranteed against the formation of objectionable green copper sulphate coatings. Perforated Plastic Liner and Cover are unbreakable and acid proof. Pan is oversized to accommodate the largest appliance and is easily lifted out of machine to empty.
2. CLIP-ON ARM	Simply slips on and off upright and holds in any desired position, at any height, in either pan. There are no revolving parts to corrode or deteriorate. The holding clip easily slips off and on arm.
3. TIMER	Automatically shuts off machine at any pre-set time. Bath requires no attention while the appliance is being polished.
4. RANGE SELECTOR	Gives a choice of high or low range for cleaning or reducing.

• • •



The Betta Cephlometric Tracing Table

INDIRECT LIGHTING
Results in an evenly lit surface free from glare and hot spots. Spring clamps hold cephalometric plates firmly in place.

FOLDING LEGS
Give table proper angled elevation for comfortable tracing and viewing position. Legs have mar-proof rubber feet and fold down when not in use.

INSTRUMENT COMPARTMENTS
Have ample room for instruments, pens, pencils, ink, tracing paper and cephalometric plates. When lid is closed, unit is a compact carrying case. Natural finish.

Model BO-3-A
8″ x 10″ indirect tungsten lighting system, $24.50

Model BO-3-B
8″ x 10″ cold fluorescent lighting system, 31.50

NEW! Model BO-3-C
10″ x 12″ cold fluorescent lighting system, 37.50

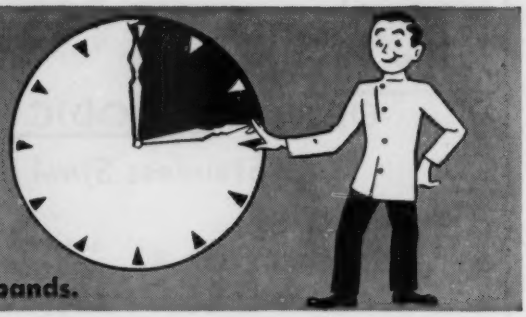
ACCESSORIES:

ANGLE MEASURE	Stores in table. Adjustable arm locks for calibrating and drawing any angle...	3.50
INSTRUMENT SET	Includes large and small compass for pencil and ink, dividers and inking pen, with case ----------	3.50

BETTA ORTHODONTIC SUPPLIES
123 WEST 64TH STREET · NEW YORK 23
"IF IT'S ORTHODONTIC . . . WE HAVE IT"

HERE'S HOW

To cut anterior band fitting time and costs, while providing better fitting and more attractive anterior bands.



1. Get an introductory selection of Rocky Mountain Tru-Form Anterior Bands, which are supplied in 14 graded sizes and in either wide or narrow widths.

2. To fit the upper anteriors take mesial distal measurement of upper central tooth,(Fig. 1.) Compare measurement to size chart and select proper size.
(If too large or too small, go up or down a size.)

"Fig. 1."

H.	8.
I.	8.5
J.	9.
K.	9.75
L.	10.50

3. Weld anterior band seating lug on lingual,(Fig. 2.)

"Fig. 2."

4. Harden labial slightly with 114 plier and bring in gingival of mesial and distal slightly with 114 plier,(Fig. 3.)

" Fig. 3."

5. Push on tooth and to finish seating rest Eby Band Driver on band seating lug and tap band to desired position.(Fig. 4.)

"Fig. 4."

6. Rules of Thumb for sizing bands to other teeth

a. For upper laterals just drop down three sizes from size used for central. Example: if you used a J band for the central, you will use a G band for the lateral.

b. Lower centrals take either size C or D or occasionally one size smaller or larger.

c. To fit the lower laterals, just go up one size larger than the size used for the lower central.

SAVE EVEN MORE TIME

By using Rocky Mountain preformed anterior bands with your favorite attachment already prewelded.

If you wish an introductory assortment of these bands or a copy of Rocky Mountain's new Band Technique Booklet, just check and mail the coupon below.

TRU-CHROME HIGHEST QUALITY

ROCKY MOUNTAIN METAL PRODUCTS CO.

BOX 1887 — DENVER 1, COLORADO

TRU-CHROME HIGHEST QUALITY

Send me introductory anterior band assortment kit
(6 doz.) $12.00 Wide ☐ Narrow ☐
Send me the new Band Technique Booklet ☐

AJ0409

Dr._____

_____

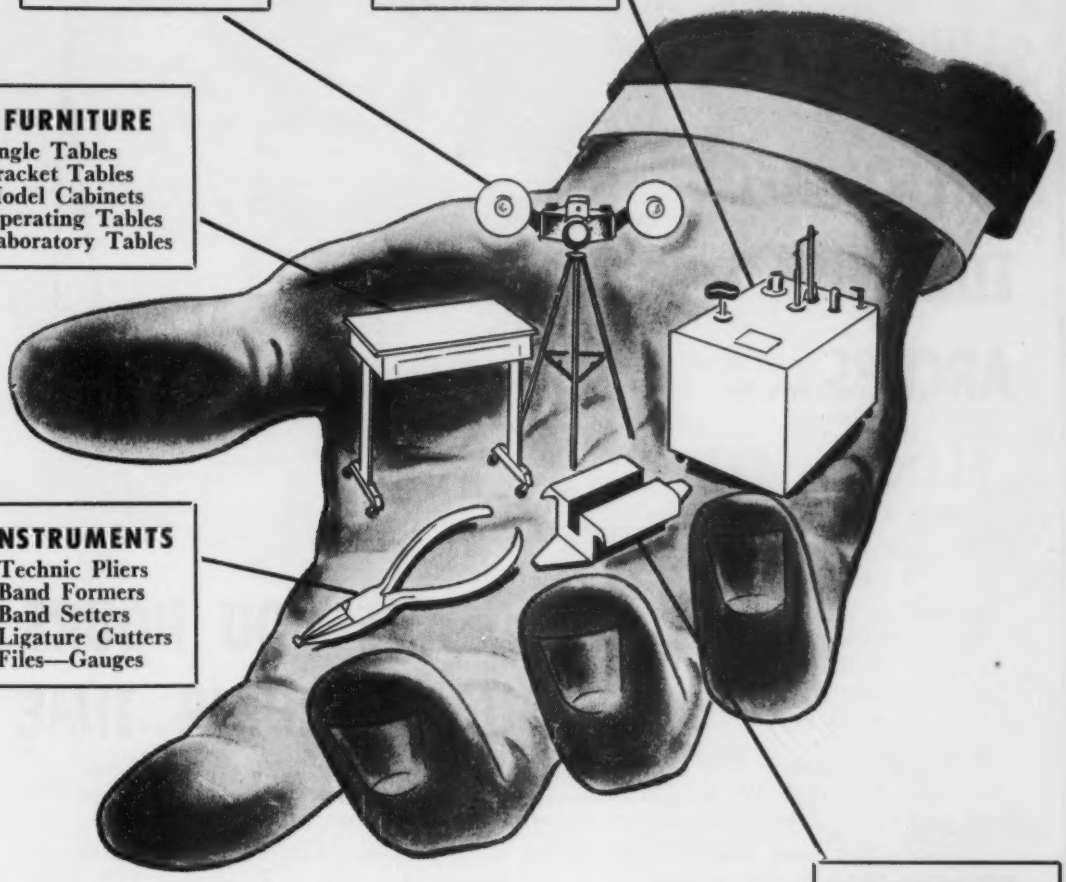
_____

ALL FROM ONE SOURCE

PHOTOGRAPHY
Photographic Units
Projector-Viewers
Tracing Units
Cephalometric Units
X-ray Viewers

EQUIPMENT
Spot Welders
Anodic Polishers
Bench Lathes
Plaster Bins
Material Cabinets

FURNITURE
Angle Tables
Bracket Tables
Model Cabinets
Operating Tables
Laboratory Tables



INSTRUMENTS
Technic Pliers
Band Formers
Band Setters
Ligature Cutters
Files—Gauges

ATTACHMENTS
Edgewise
Twin Tie
Lingual
Buccal Tubes
Extra-Oral

• **ORTHO CHROME**
SARDA CHROME
Wires—Tubing
Molar Bands
Band Material
Solder—Flux

• **PRECIOUS METAL**
Aderer's
William's
Wires—Tubing
Bands
Attachments

Orders are shipped the same day as received

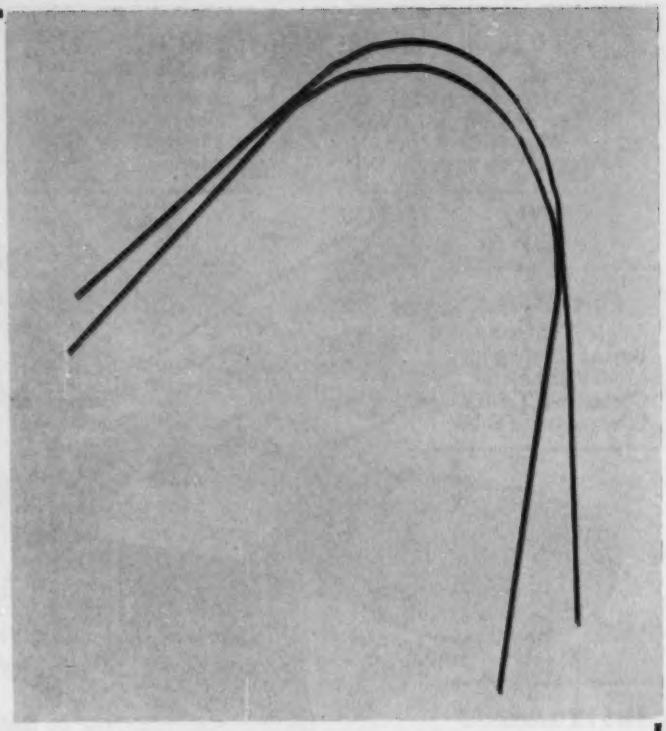
Ask for our postage paid order forms

OPERATING AIDS
Ortho-Cement
Impression Material
Separating Wires
Ligature Wires
Impression Trays

LABORATORY AIDS
Blow Pipes
Tray Cleaners
Soldering Stands
Model Formers
Motor Tools

BETTA ORTHODONTIC SUPPLIES
123 WEST 64TH STREET · NEW YORK 23
"IF IT'S ORTHODONTIC . . . WE HAVE IT"

HENRY PREFORMED EDGEWISE ARCHES . . .



. . .WILL SAVE YOU HOURS OF VALUABLE CHAIR TIME

YOU KNOW HOW MUCH time you spend in forming arches. And you know how much your time is worth. And now you can save most of that time. . . .

Henry Preformed Edgewise Arches are made of either Unitek or Rocky Mountain rectangular edgewise wire in sizes .021 × .025 and .0215 × .028, or Wilkinson's high spring gold alloy rectangular wire, .021 × .025.

Henry Arches incorporate a plainly marked median line, the necessary set-in and set-out sections for the centrals, laterals and cuspids, and the newest conception, the set-outs for the bicuspids. In addition the arches incorporate lingual crown torque of five degrees in the upper arch and eight degrees in the lower, and ample material is allowed in the molar sections for forming tie-backs.

The upper arch is made for an ideal case measuring 23 m.m., but may be manually adjusted to your chart quickly and easily for cases ranging from 21 m.m. to 25 m.m. The same is true of the lower 18 m.m. arch with a range of from 16 m.m. to 20 m.m.

The following prices prevail on upper and lower chrome alloy arches in wire sizes .021 × .025 and .0215 × .028:

1 to 24	$ 1.10 each	In Wilkinson's
3 to 4 dozen	12.60 dozen	high spring gold
5 to 8 dozen	12.00 dozen	alloy, uppers or
9 to 16 dozen	11.75 dozen	lowers . . . $30.00
17 dozen and up	11.40 dozen	per dozen.

Samples available upon request

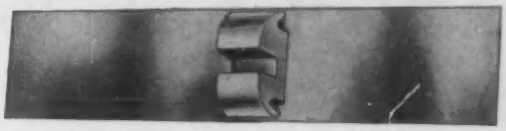
HENRY ARCH MANUFACTURING CO.

8120 Kenyon Avenue — Los Angeles 45, California

"CHROMEX"

ORTHODONTIC PRODUCTS • PLIERS • INSTRUMENTS DESIGNED and ENGINEERED FOR THE ORTHODONTIST

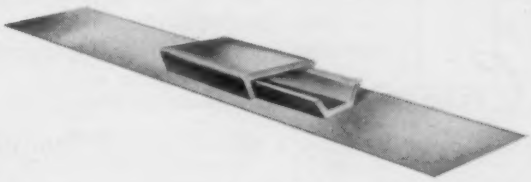
EDGEWISE ANTERIOR and POSTERIOR BRACKETS —WITHOUT— —FLANGES— WELDED TO CHROMEX BAND MATERIAL



This flangeless innovation in bracket design will permit the Orthodontist to form a tru-fit band that will follow the anatomical contour of the teeth—an accomplishment not possible with the flanged brackets.

Edgewise Anterior Brackets Welded to Band Material—**$2.80 Doz. . . $30.50 Gross**
(Sizes: 125 × 003; 125 × 004; 150 × 003; 150 × 004; 100 × 004)

Edgewise Posterior Brackets Welded to Band Material—**$3.30 Doz. . . $36.25 Gross**
(Sizes: 125 × 003; 125 × 004; 150 × 003; 150 × 004; 180 × 004; 180 × 005)



TWIN-ARCH

BRACKETS and CAPS

WELDED TO CHROMEX BAND MATERIAL

Precision-made, finest quality material and smoothly polished as are all Chromex Brackets.

Twin-Arch Brackets Welded to Band Material—**$3.60 Doz. . . $39.50 Gross**
(Sizes: 100 × 003; 100 × 004; 125 × 003; 125 × 004; 150 × 003; 150 × 004)

Caps for Twin-Arch Brackets—**$2.60 Doz. . . $28.50 Gross**

OUR *NEW* INTERMAXILLARY HOOKS and END SECTIONS WITH HOOKS are produced as welded segments without use of solder.

Intermaxillary Hooks .030; .036; .040
$1.65 Doz. —$18.25 Gross

End Sections With Hooks 0.36; .040
$2.80 Doz. —$30.75 Gross

CHROMEX ANTERIOR and POSTERIOR BRACKETS WITH FLANGES IN STRIPS OF 12

CHROMEX DIAMOND DRAWN ROUND WIRE • EDGEWISE WIRE STRAIGHT LENGTHS

A Complete Line of Orthodontic Pliers and Instruments Designed and Engineered for the Orthodontist . . . Exclusively!

Send for Catalog

GILBERT W. THROMBLEY

33 WEST 42nd STREET, NEW YORK 36, N. Y.

Formerly Atlantic Coast Distributor for Rocky Mountain Metal Products Co.

THE HYDR O SEAT

A Stable Hydraulic Positioner for Cephalometric Radiography

$115.00
as illustrated

Precision positioning between seat levels of 23 in. to 42 in. Patient is raised and lowered hydraulically by foot controls. Positive control within 1/100 in.

Compact and sturdy, the Hydr O Seat occupies only 1 square foot of floor area. It is engineered to meet your requirements of performance and utility.

Attractive finish in black and ivory with chromium plated controls. Comfortable foam rubber swivel seat upholstered with durable, black Naugahyde.

* Electrically operated units available for fully automatic operation.
* Attachments and modifications on special order.

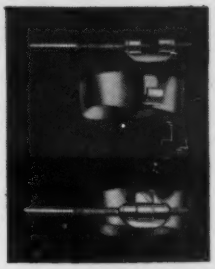
Mix O matic
for
Bubble free plaster in 15 seconds.

Ang O lator
for
Fast, exact model trimming.

The Klippert Co.

19137 Dike St., Covina, California

SOME OF NEY'S ORTHODONTIC SPECIALTIES



ORTHODONTIC LOCK

Makes removal and reinsertion of either lingual or labial arch extremely simple. Permits exact and rapid lengthening or shortening of arch — 1/100 inch per revolution of swivel—without disengaging it from bands on anterior teeth. Allows arch to lie in a straight line at the gingival margins, doing away with vertical bends.

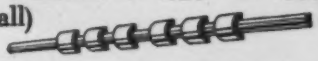
TUBES AND SHAFTING

TUBES — HALF ROUND

DL-8, length .08″; DL-10, length .10″ (Inside dimensions .032″ x .064″; .012″ wall)

DL-10H, length .10″ (Inside dimensions .032″ x .064″; .014 wall, extra heavy)

DS-8, length .08″; DS-10, length .10″ (Inside dimensions .020″ x .040″; .010″ wall)



SHAFTING — HALF ROUND

NEY-ORO ELASTIC #4, special shape to fit DL and DS tubes. PALINEY #7, special shape to fit DL and DS tubes. 3 inches of shafting to 1 dozen tubes is usual proportion.

WIRE SIZES

- Round Arch Wires
  .032″ .036″ .038″ .040″
- Auxilary Springs
  .020″ .022″ .025″
- Ribbon Arch Wires
  .022″ x .028″ .022″ x .036″
- Rectangular Arch Wires
  .022″ x .025″ .022″ x .028″ .022″ x .036″
- Square Arch Wires
  .022″ x .022″ .024″ x .024″

5 dwt. container of solder in wire form. 26 ga. and 28 ga.

SOLDER SHAPES

- Band Solder, .809 fine
  Each piece .20″ x .062 x .0075″.
- Attachment Solder, .560 fine
  Each piece .127″ x .062″ x .0075″.
- Solder Ferrules, .560 fine
  Each piece .032″ inside diam. x .003″ wall.
- Solder Disks, .560 fine.

ROUND TUBES

R-025, length .25″, fits .040 wire
R-125, length .25″, fits .036 wire
R-135, length .35″, fits .036 wire
R-145, length .45″, fits .036 wire
R-220, length .20″, fits .030 wire
R-310, length .10″, fits .025 wire

Wall thickness of all around tubes is .012″.

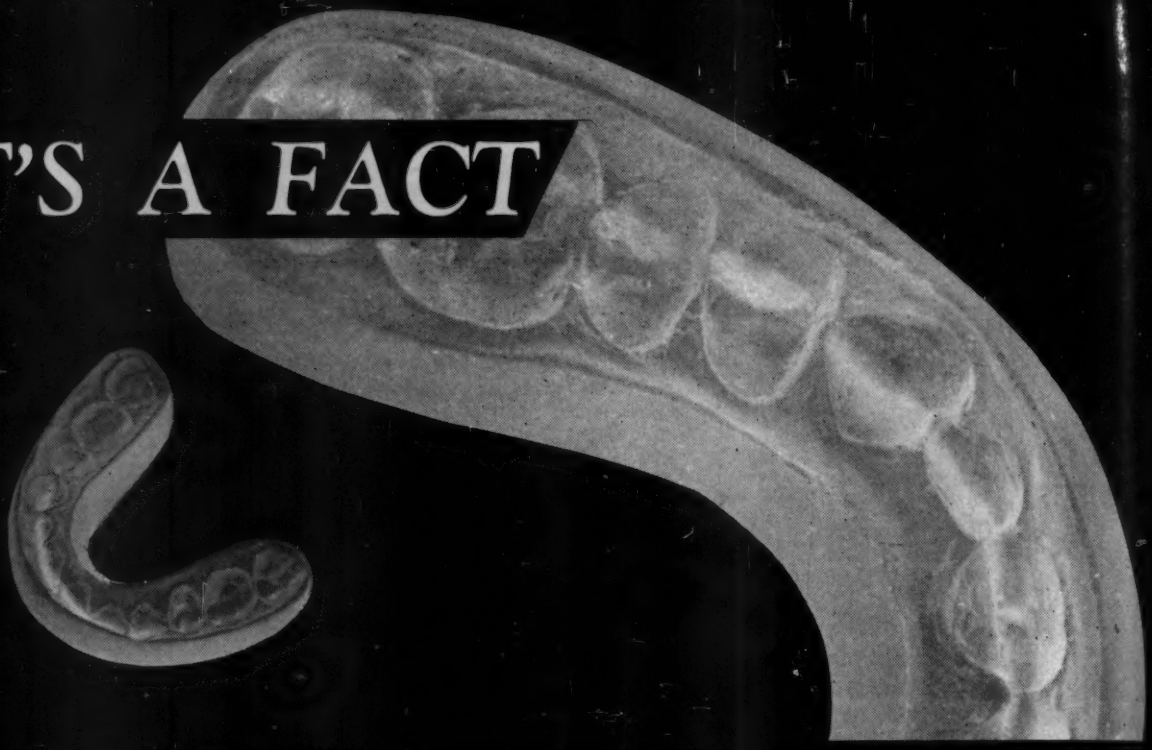
RECTANGULAR TUBES

.022″ x .028″, 5/16″ long

THE J. M. NEY COMPANY Gold SINCE 1812

HARTFORD CONN.

IT'S A FACT



The number of orthodontists finishing their cases with Tooth Positioners has more than doubled in the past two years.

This is evidence in itself that more and more orthodontists are realizing that only a Positioner can offer the retention and accomplish the final movements required when appliances are removed.

Don't accept inferior imitations

The LaPorte Tooth Positioning Laboratories are the only persons authorized to fabricate for sale elastic tooth positioning appliances that are constructed over a pre-determined pattern, the set-up. We have been given these exclusive rights by Dr. H. D. Kesling, D. D. S., M. D. S., the originator, developer and holder of U. S. Patents on this method of tooth movement.

$15.00 with your set-up

$25.00 with our set-up

La Porte — T-P — Laboratories

P. O. Box 73

La Porte, Indiana

Serving The Orthodontist

INTRODUCING THE . . .

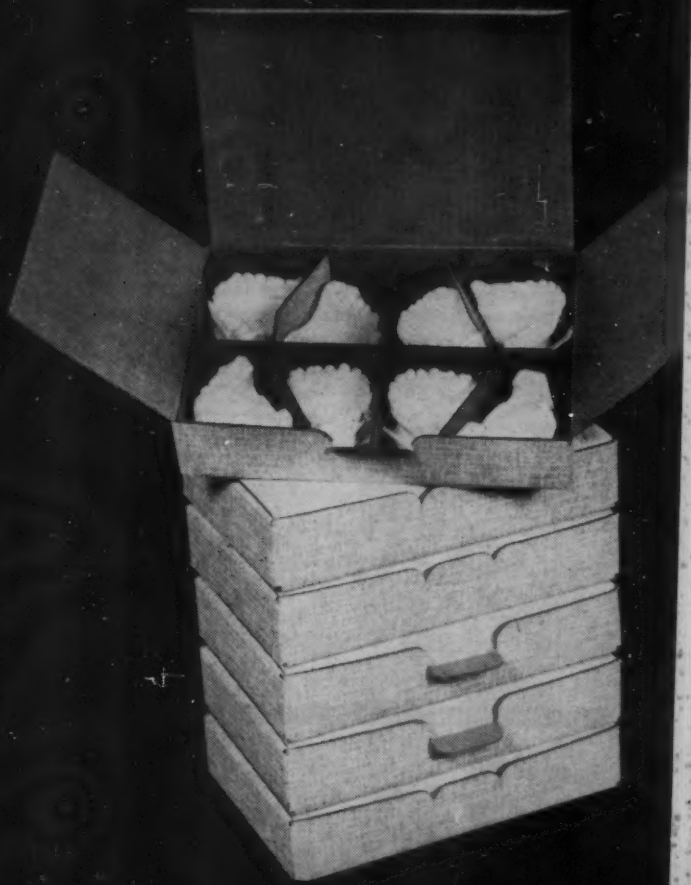
MODEL "T" BOX

T-P'S ALL-NEW MODEL STORAGE BOX.

"Fits Your Models to a 'T'"

- Holds 4 sets of models in complete safety in separate compartments.
- Beautiful brown and white linen finish on strong double face corrugated board.
- Dust proof — models need not be wrapped and can thus be quickly identified.

THIS ADVERTISEMENT SHOULD COST YOU MONEY!



- Quickly assembled from a flat, easily stored single piece.
- Can be neatly stacked and labeled on any side for easy identification.
- Generous 9 3/4" x 6 1/4" x 2" —for models of all sizes.

$22.50 per 100

Free Sample Upon Request

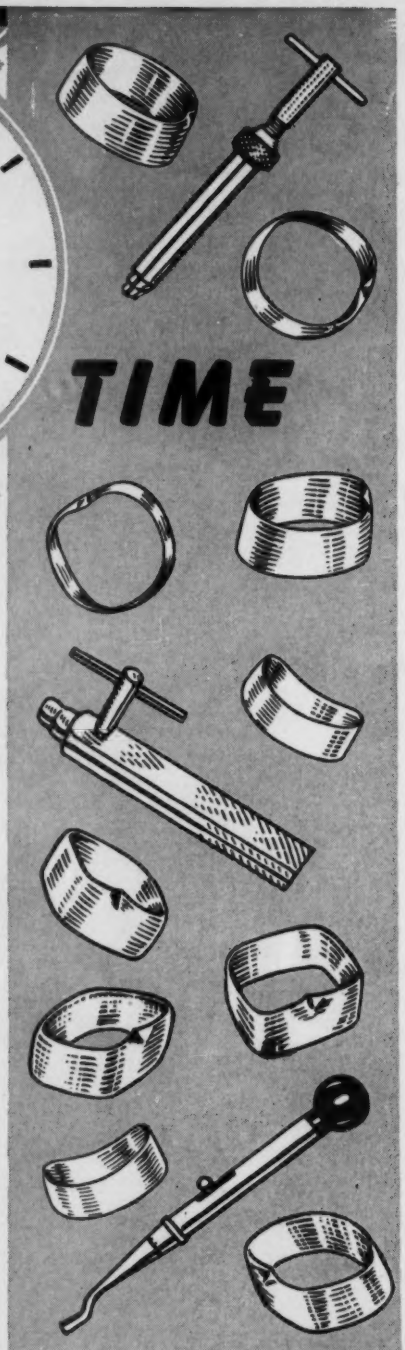
LaPorte T-P *Laboratories*

P. O. Box 73

La Porte, Indiana

Serving The Orthodontist

How to SAVE on OPERATING TIME



USING ROCKY MOUNTAIN'S TRU-FORM SEAMLESS BAND TECHNIQUE YOU CAN REDUCE BAND FITTING TIME OVER 75% WHILE PROVIDING MORE ATTRACTIVE AND BETTER FITTING BANDS.

It is a fact that band fabrication and fitting is the most time-consuming operation in orthodontics. By saving time here you can take more advantage of the great and growing demand for your services. You can treat more cases with less effort and expense, and thus realize greater returns for your efforts.

Rocky Mountain's new Tru-Form Seamless bands are not merely metal rings. They are the outcome of years of research and experience, and are scientifically designed and manufactured to fit the confirmation of the individual tooth. The bands are fabricated from a special Tru-Chrome Alloy which is very ductile and easy to work with. The remarkable material work hardens as yau contour it, so the band can be made to fit tightly around the gingival with a spring-like tension.

TRU-FORM MOLAR BANDS—12 sizes in maxillary and mandibular anatomical forms only .....**$4.50** a dozen

TRU-FORM ANTERIOR BANDS—14 sizes wide or narrow only .....**$2.00** a dozen

TRU-FORM BICUSPID BANDS—6 sizes only.....**$2.00** a dozen

The techniques are amazingly fast and simple: Measure tooth and select band (your assistant can do this and have several bands ready for you) contour as directed, and seat in place. Of course, like any thing fine in the profession, definite methods must be applied. Rocky Mountain has just recently completed an illustrated booklet covering the most effective techniques for using these great time savers. If you wish one of these interesting booklets, just mail the completed coupon.

TRU-CHROME HIGHEST QUALITY

ROCKY MOUNTAIN METAL PRODUCTS CO.

P. O. BOX 1887 DENVER 1, COLORADO

Please Send New Band Technique Booklet ☐

DR._____

ADDRESS_____

CITY_____ ZONE____ STATE_____

American Journal
of
ORTHODONTICS
(All rights reserved)

VOL. 42 FEBRUARY, 1956 No. 2

Original Articles

PRESIDENT'S ADDRESS, CENTRAL SECTION OF THE AMERICAN ASSOCIATION OF ORTHODONTISTS

HOWARD YOST, D.D.S., F.A.C.D., GRAND ISLAND, NEB.

I WISH to thank the members of the Central Section for the honor and privilege of serving as president for this year of the eighteenth annual session.

During the past year the progress of our section has continued. We can be proud of the many fine new members who have been received into our midst as orthodontists inspired with a zeal for increasing the standards of the practice of orthodontics. Also, we can be proud of the increasing number of our members qualified to become diplomates of the American Board of Orthodontics. The Central Section stands among the highest in percentage of members who have been certified by this board which is the first specialty board in dentistry and the third ever created in medicine or dentistry. These are all encouraging signs on the part of the individual member to raise the level of competency in the practice of this specialty. It is hoped that competency and proficiency for the welfare of the patient will always remain foremost in our endeavors.

Even with the progress our organization has made, there are always problems remaining to be solved. At the present time there appear to be two problems requiring our attention. One is the difference of opinion as to what constitutes acceptable qualifications for membership. The second pertains to the matter of transferring of patients from one orthodontist to another.

Presented at the eighteenth annual session of the Central Section of the American Association of Orthodontists, Des Moines, Iowa, Oct. 3, 1955.

During the past year or so there has been much discussion whenever orthodontists met over what changes, if any, should be made for requirements for membership in the American Association of Orthodontists and the sectional societies. A special committee on admissions was appointed to make recommendations to the Board of Directors of the A.A.O. This committee's recommendation to the Board of Directors was by no means unanimous. The recommendation proposed that our by-laws be changed and that acceptance for membership consist of three years of exclusive practice by those who had completed a minimum of 1,500 hours in orthodontists in an approved dental school and were in good standing in local, state, and national organizations. This proposal was enacted and our by-laws were amended at the last A.A.O. meeting in San Francisco by a vote of 117 to 92; less than 10 per cent of the total membership of the A.A.O. voted for this change of our by-laws. This amendment completely cut off the preceptor plan of training. Following the adoption of this amendment, it was voted at the last business session of the San Francisco meeting that a special committee be appointed to consider requirements for membership through preceptor training programs. Also, our own member, the late Dr. William A. Murray, introduced an amendment which provides that, in the future, major questions pertaining to affairs of the A.A.O. may be referred to a ballot by mail of the entire membership on the recommendation of the board of directors. One thing is certain: all these proposals were made in good faith, and I am sure that good will come of them.

Training for medical specialties is through graduate, postgraduate, and hospital residency programs. By far, the greatest amount of specialty training is through hospital residency programs. The latter require an average of two to five years. Admission for membership into medical specialty organizations is through examination by their respective boards.

The preceptor plan of training in orthodontics compares favorably with hospital residency training programs in the medical specialties. Orthodontics, unlike oral and maxillofacial surgery, is not a hospital practice; therefore, a residency program in hospitals is an impossibility. The alternative is an accepted, supervised preceptor training program under the direction of diplomates of the American Board of Orthodontics.

A preceptorship under such men as the late Drs. Albert H. Ketcham, John V. Mershon, Harry Kelsey, Milo Hellman, Edward H. Angle, Calvin Case, C. A. Hawley, and Martin Dewey, to name only a few of our revered pioneers, as well as under hundreds of our members in practice today, might well be a highly coveted privilege.

Graduate and postgraduate training satisfies the need to provide more trained men in the shortest length of time with little practical experience. Preceptor training provides the possibility that a dentist can avail himself of the opportunity to obtain specialized training in a less concentrated form in a greater number of years, with a broad base of clinical experience and an intense participation of practice.

While it is desirable to have uniform standards for membership in the A.A.O., at the same time some thought should be given to the desirability of uniform training programs in our graduate schools. Likewise, the same would be true of preceptor training programs.

In recent years the study of the science of orthodontics has broadened its scope to delve into the entire realm of the physical and functional phenomena of the human organism. More must be learned of the allied basic sciences to understand problems that we are forced to cope with in order to rehabilitate our patients to as nearly as possible the optimum of social acceptance. In this respect, it might be suggested that the A.A.O. set up a Council of Orthodontic Education, similar to the Council on Dental Education of the American Dental Association, so far as orthodontic education is concerned. Such a council would supervise, direct, and standardize the curricula of orthodontic education on the graduate and preceptor level so that, no matter how training was obtained, the same end result would be gained. This council should collaborate with the Council on Dental Education of the American Dental Association to disapprove all dental schools which do not offer the full curricula of undergraduate training. This council would replace our present Committee of Education of the A.A.O. Such a council could also provide for a basic manual of study for orthodontic training. An examination for admission to membership could be based upon the pattern of training set forth in this manual.

At last year's meeting the committee appointed to report on past-president Earl Shepard's message concurred in his recommendation that a committee be appointed to study the matter of providing routine information on transferral cases. Such a committee has been appointed and will report to a business session at this meeting. It appears, however, that something more than just routine information is required, in some instances, to make a smooth transition of treatment from one orthodontist to another.

In this respect, I am compelled to refer to a recent editorial by Dr. H. C. Pollock, entitled "Public Relations," which appeared in the August, 1955, issue of the AMERICAN JOURNAL OF ORTHODONTICS. In that editorial, Dr. Pollock stated: "There can be no place in the scheme of any department of any modern health service for a situation wherein one certified operator is unable to replace another specialist because of divergence of background in education or an overdedicated indoctrination, prejudiced to some particular appliance or another, its record of service notwithstanding."

In past years we have witnessed many essay programs and symposiums with case reports, demonstrating different methods of treatment of identical types of malocclusions and malformation of the supporting structures. In each instance, the various methods of treatment showed credible results. Therefore, we must come to a realization of a generalized acceptance of different methods of treatment and the acceptance of the basic fact that there is more than one way to accomplish the same end. With this understanding, we will be able to make greater use of referral information and, at the same time, to progress with the treatment without unnecessary interruption and

delay to the patient and added expense to his family. Promoting a better understanding and agreement upon these factors requires all sections of the A.A.O. to point toward a goal of acceptance of uniform basic training in our graduate and preceptor programs and the acceptance of the validity of the divergent philosophies in the practice of orthodontics.

It is not expected that the new orthodontic graduate be highly skilled in the art and practice of his chosen profession, or have his energies and attention directed toward one single philosophy of treatment or one mechanism of therapy. Rather, he should be taught the basic principles of all proved and accepted methods of the day so that he then can choose the method most suitable for the particular case. It is presumed that he will not become a "Jack-of-all-trades" but, with time and practice, will develop the skill and judgment suitable to his individual aptitude. This will help him to understand and gain respect of the thinking and skill of others. Perhaps more time should be devoted to all the basic treatment techniques and less to research. At the completion of this training, should the pursuit of research be desired, ample facilities could be made available at the postgraduate level.

I should like to make two recommendations to this body for your consideration and, if they meet with approval, they will be forwarded to the Board of Directors of the A.A.O. The first has to do with an enlargement of the previous suggestion by the late William A. Murray concerning the mechanics of changes in our constitution and by-laws. This would provide that all proposed changes in these instruments must be published in three consecutive issues of the AMERICAN JOURNAL OF ORTHODONTICS and, after such publication, the members must be polled by a mail ballot. Second, it is recommended that a Council of Orthodontic Education be created with the power to direct, supervise, and standardize orthodontic education on the graduate and preceptor level. This council could be given the prerogatives of preparing and revising a manual of basic orthodontic training and submitting examination questions, based upon the pattern of the manual, to examining boards for each sectional society for admission to membership into A.A.O. and sectional societies. This council would replace the present Committee of Education of the A.A.O.

The path of progress is not always smooth. It may be set with pitfalls and stumbling blocks. As mature men, with a determination to face these obstacles with practical realism, we can smooth the onward way.

In closing, I would like to express our thanks and gratitude to the men and women who have made this meeting possible. To the Program Committee, for the superb essays they have provided, and to the essayists themselves, to the Clinic Program Committee and those who have prepared clinics, to the local Arrangement Committees for the cordial hospitality they have given us, to all appointed and elected committees, to all the officers especially to our genial, ever-willing, and hard-working secretary, Fredrick B. Lehman, we all owe a hearty "thank you."

803 WEST DIVISION ST.

THE EARLY EXPANSION OF DECIDUOUS ARCHES AND ITS EFFECT ON THE DEVELOPING PERMANENT DENTITION

RICHARD E. BARNES, PH.B., B.S., D.D.S., CLEVELAND, OHIO

EARLY intervention for the correction of orthodontic problems has been a neglected phase of our treatment for too long a time. There is enough evidence at hand at the present time to contradict the often heard statement: "Wait until all the permanent teeth have erupted before starting corrective procedures." Unfortunately, we still hear such advice in instances where it should not apply. Some of the pioneers in our specialty advocated early treatment and their results substantiated their teachings, but the advice of these farsighted men was not adhered to and the pendulum swung the other way.

We may ask, then, why the interest in early treatment waned. I suppose the answer would be that the mechanics used was not always satisfactory and, most important too, lengthy enough retention and muscle training were not given proper consideration. Those few who advocated early intervention must have had successful results to have held their convictions so long. There are points in favor of early treatment and there are points in favor of watchful waiting, and so we should not be arbitrary in our thinking. Our duty is to know when to intervene and when not to. Early expansion will not solve all our problems; neither will delayed treatment be to the best interest of the patient in all instances.

Sly,[4] Subtelny and Brodie,[10] V. E. Barnes,[3] Baker,[11] Hawley,[6] Lischer,[2] Bogue,[1] Kloehn,[12] and a host of others have written about and advocated early intervention in orthodontic problems, but this article is on only one phase of early treatment—that of expanding the deciduous arches in such a manner that the widened deciduous roots will have a widening effect on the developing permanent successors.

This study of the expansion of the deciduous arches has been going on in my office for the past twenty-four years. It has not been presented until I felt that the results were stable after several years out of retention. Too often, it seems to me, we are presented with theories and practices that seem worth while on first observation, but do not stand up under the test of time. Enough cases have been handled to convince me that the vast majority of them will stand the test of time.

Let us see what has been written on early treatment. Brodie[5] has recently written on the value of the muscles in arch formation. He feels that by early change in the dimensions of the muscle attachments, the muscle can be trained

Presented before the central section of the American Association of Orthodontists, Des Moines, Iowa, Oct. 3, 1955.

to its new form. According to Brodie, "The reason why so many malocclusions, particularly of the crowded type, do not improve once the teeth have erupted is due to another system which is a part of our field of operation. This is the musculature."

Bogue[1] voiced the very same sentiments as Brodie when, in 1908, he said: "The statement that 'the tongue within, the cheeks and lips without are the main instrumentalities in the formation of the dental arches from the early stages of embryonic life, right on until maturity' is not by any means new, yet few practitioners realize the musculature and mechanical power of the tongue." Then he goes on to say: "When, therefore, the deciduous molars are moved into the positions they ought to occupy, they carry with them these crypts of the permanent teeth which after the deciduous teeth have fallen out develop their own roots in the positions to which they have been transplanted and become rooted there. No injury has been inflicted on the permanent teeth by the appliances."

Bogue maintained that irregularities destined to occur in the permanent teeth were clearly shown in the deciduous set at 6 years and that correcting irregularities in the deciduous arch corrects irregularities in the succeeding permanent arch. I believe that these statements would be nearer to the truth if Bogue had said that *some* irregularities of the deciduous teeth show irregularities of the permanent set and that correcting *some* irregularities in the deciduous set will bring about certain corrections in the permanent set, and not necessarily all of them. For instance, to mention one example, rotations that are present before the teeth erupt may not correct themselves as room is made for their eruption, although in some instances they will.

This brings us to the point that when early treatment is planned, a secondary phase of treatment most likely will be necessary and should be counted on, even though it turns out that it is not always necessary. Some do not like to think of a secondary phase of treatment. This attitude should not prevail when the patient's best interests are involved.

Hawley,[6] in a paper written in 1912, recalled early methods of expansion particularly in the maxillae where the aim was to open the maxillary suture. By the use of the so-called jackscrew and soldered attachments to banded teeth, he opened spaces between the central incisors as much as one-fourth of an inch. His belief was that, while the suture could be opened somewhat, the space between the central incisors was greater than the suture space, so the answer was not entirely one of suture opening. This idea as to how the expansion took place prevailed in the minds of those early pioneers, but it did not explain how a corresponding amount of expansion could result in the mandibular arch. My own clinical experience leads me to believe that there is some slight opening of the maxillary suture during the type of expansion described in this article, but I am not prepared to say that this is a permanent thing or that it has a direct bearing on the permanent width obtained.

Lischer,[2] in 1907, said: "If teeth showing signs of assuming a position of malalignment could be forced into normal relations before the completion of roots and alveoli, a good prognosis would nearly always be assured."

Anderson[7] has commented on the experiments of Breitner and Tischler on monkeys whereby they showed that the germs of the permanent teeth followed the movement of the deciduous teeth even in the instances where the deciduous roots moved away from the permanent tooth germs. He states: "On the strength of these findings, one is apparently justified for instance in expecting to obtain a wider permanent arch by orthodontic expansion of the deciduous arch."

If, as Breitner and Tischler say, by the expansion of the deciduous teeth, the crypts of the permanent teeth are moved along with them, what excuse do we have for delaying our treatment, provided that our mechanics of expansion is such as to move the deciduous roots bodily and provided that we can maintain this expansion a sufficient length of time for the adequate training of the surrounding musculature, and provided, of course, that good judgment as to the extent of the expansion is used? We cannot hold expansion that Nature will not tolerate, but Nature will tolerate a surprising amount of expansion if the musculature is given time to adjust itself to this new width. We can overexpand within limits in these early expansion cases, but common sense should guide us in our limits. Overexpansion cannot be held. Certainly the genetic pattern will limit the amount of expansion possible, for in the light of recent research it seems reasonable to believe that we do not alter the basal bone even though some of our results make it appear as if we had.

V. E. Barnes,[8] in 1907, wrote: "The expansion of many temporary arches involves but a single operation compared to what would be necessary were the irregularity allowed to progress with the eruption of the permanent teeth. The absorption of the temporary alveolus is coincident with the eruption of the permanent teeth, which have their alveolus formed around them after eruption. If this formation can be compelled to occur about the teeth in correct position, it is very evident that the retention will be permanent—and the case therefore comparatively simple." In a recent report on a thesis completed at the University of Illinois, Brodie[5] substantiates this idea of new alveolar formation about the newly erupted or erupting permanent teeth and pegs its beginning at a dental age of about 5 years. According to Todd,[9] the second most active growth period in the life span is from the ages of 4 to 7 years. It would seem, then, that if we are able to take advantage of growth, this cycle of from ages 4 to 7 would be the ideal time to apply our mechanics.

Some men are extracting in a high percentage of the cases they treat and do so because they feel that the arch length is not sufficient to support all the teeth. On this basis, we would say that a good majority of the youngsters brought to our offices have crowded anterior teeth and so where there is not anterior spacing at the time the mandibular deciduous central or lateral incisors are lost or when these teeth are obviously erupting in a rotated or crowded manner, later crowding usually will be the case and widening procedures are indicated. In saying "usually," I realize that there is the exception and sometimes simple anterior crowding will straighten out through the tongue action alone, so here again the diagnostic experience of the operator

must be relied upon. Where there is conviction that ultimate crowding will result, the x-ray report of the four deciduous canines is checked and if these teeth are intact and show no signs of root absorption, it is reasonable to expect that bodily movement of these deciduous teeth will have an influence on the developing permanent teeth in the alveolar bone.

Treatment may be contraindicated when certain permanent teeth are missing (as maxillary or mandibular incisors or premolars), where obvious bimaxillary protrusion exists, where ankylosed deciduous molars are present, and where the deciduous canines have started to absorb.

It is true that the potential must be there if we are to meet with success in early treatment, and by this potential I do not refer to those seemingly crowded cases that are self-corrective.

If it is possible to prevent the development of later orthodontic problems, we should do all in our power to do so. Orthopedic problems are tackled as soon as the problem is evident; why should not our orthodontic problems be handled as soon as the cooperation of the patient will permit?

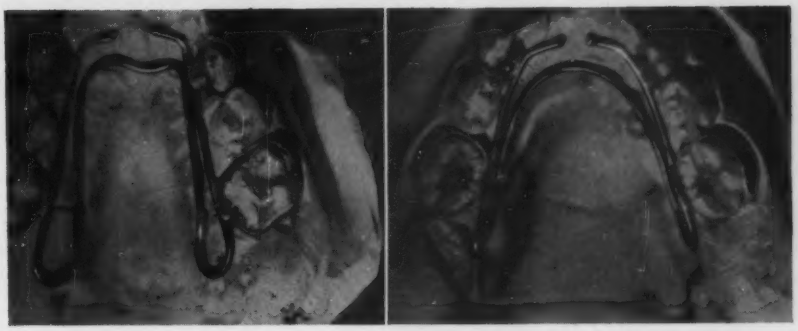
I believe that the early widening process has some effect on widening the developing permanent arches. We have been told by competent researchers that this is so but, above all, this widening allows the permanent teeth to erupt with freedom; the tongue can play its part and, most important, the musculature including the tongue will be trained to this wider framework. It is very important to retain these expanded arches as long as possible. The more cases I treat in this manner, the more I am convinced that the appliance should not be removed until the shedding of the abutment teeth makes it necessary. Here I refer mostly to the canines. Frequently I release the canine band from the appliance so that the deciduous tooth may be removed, but continue to keep the rest of the appliance in the mouth until the premolars erupt. It is the usual thing for the permanent successor to erupt directly under the expanded deciduous tooth.

Unilateral or bilateral cross-bites of the deciduous arches are ideally treated by the method described in this article. Usually such conditions are found to need bilateral expansion in the maxillary arch. The mandibular arch is usually shifted into an accommodation bite for reasons of comfort and function, shifting the center line of the mandible to the right or the left. Reciprocal expansion of the maxillary arch corrects not only the cross-bite, but likewise the centric relation.

APPLIANCE

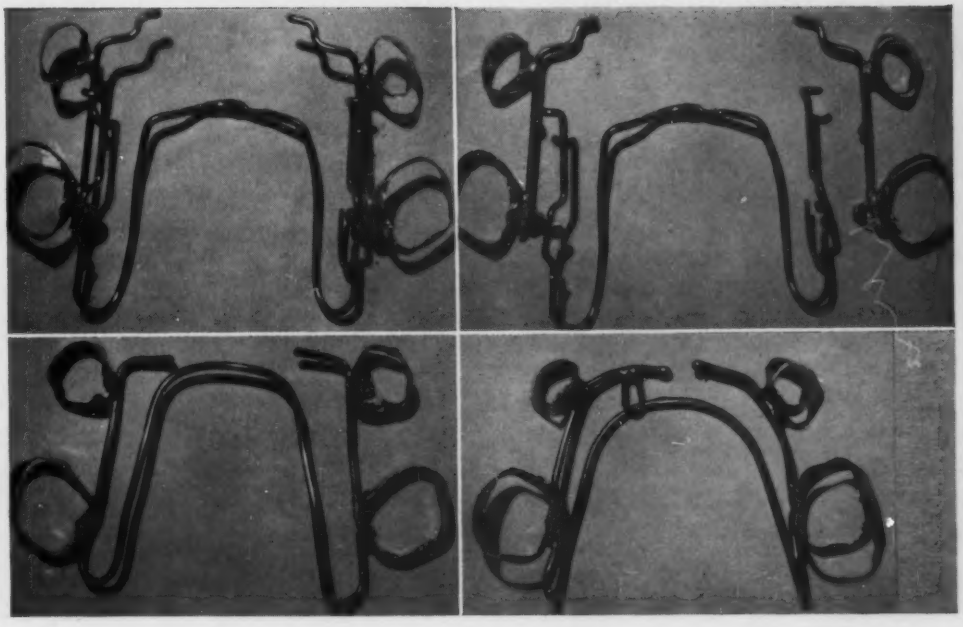
While we have been proud of the fact that orthodontics has progressed from basic appliance therapy only to the application of better diagnosis and knowledge of growth and development, we still have to consider the pros and cons of various appliances. Some appliances do what others will not or, to put it another way, one type of appliance will not do everything. It is important, I feel, that one should not limit his appliance therapy to one method alone.

A.



B.

C.



D.

Fig. 1.—*A*, Appliances on casts at completion of expansion. *B*, Upper appliance on left; lower appliance on right. *C*, Upper removable appliance. (This type of appliance is suggested only when recementing for each adjustment is not desirable.) *D*, Fixed type appliances (recemented at each adjustment).

The mechanics of the appliance described in this article are such that any expansion of the crowns of the deciduous teeth will have an equal expansion of the roots of these same teeth. Because of this root expansion and the close proximity of the crowns of the developing permanent successors, there is a widening effect on the developing teeth and when they erupt they do so without interference into a wider arch than would have been possible otherwise.

The root movement obtained is, in my opinion, the basis for any success derived from this method of expansion. The mechanics is simplicity itself. The banded teeth of each buccal segment are connected by a fixed wire of ample rigidity. There is no tipping of the crowns of the teeth. Reciprocal lateral pressure applied to the molar bands through the lingual arch wire that is soldered to these molar bands not only applies a widening pressure to the crowns of these molars, but also applies the same force at the apex of these teeth. Thus, the width obtained at the crown of the tooth should be, and is, the same as that width obtained at the apex of the root. Any banded tooth connected to the molar tooth by a soldered bar must, then, respond in its widening action by the root of the tooth moving the same distance as the crown of the tooth. It is in this manner that the developing permanent canine is influenced to move out into a wider position, and when it erupts it will do so in a wider arc than it could otherwise.

One of the objections raised to the conventional labial arch wire has been that expansion in the molar region may cause mesial drift of the molars. This is probably true, because the depth of the arc is shortened as the curve becomes straightened out. It is only true, however, when the molar bands are ligated to fixed attachments on the arch wire and if the arch wire is, in turn, attached to the anterior teeth.

The lingual appliance described in this article does not create a mesial or anterior force. It is my belief that this is due to the fact that, first, the lingual activating wire is not held adjacent to the anterior teeth as the expansion is carried out and, second, this activating arch wire extends in a distal direction past the molar bands before it is recurved forward to be attached by a solder joint to the molar band. The force applied is thus reciprocal in a lateral direction with no tendency to any mesial drift. The design might be compared to a pleat in an accordion bellows.

The basic principles of the appliance used for this early expansion can be traced back to a method devised by Ainsworth[13] and reported by him in 1904. He used it to gain root movement in the permanent teeth. Developments on Ainsworth's appliance were made by V. E. Barnes and involved the vertical hinge principle. Bars were soldered to the bands to hold several teeth together and, because of a vertical tube, root pressure could be applied to one tooth and it could be relayed to another.

The particular appliance referred to in this article is usually constructed of precious metal. The maxillary and mandibular deciduous canines and the deciduous second molars are banded, closely adapting the teeth, and carried well under the free margin of the gingival tissue. Impressions are then made

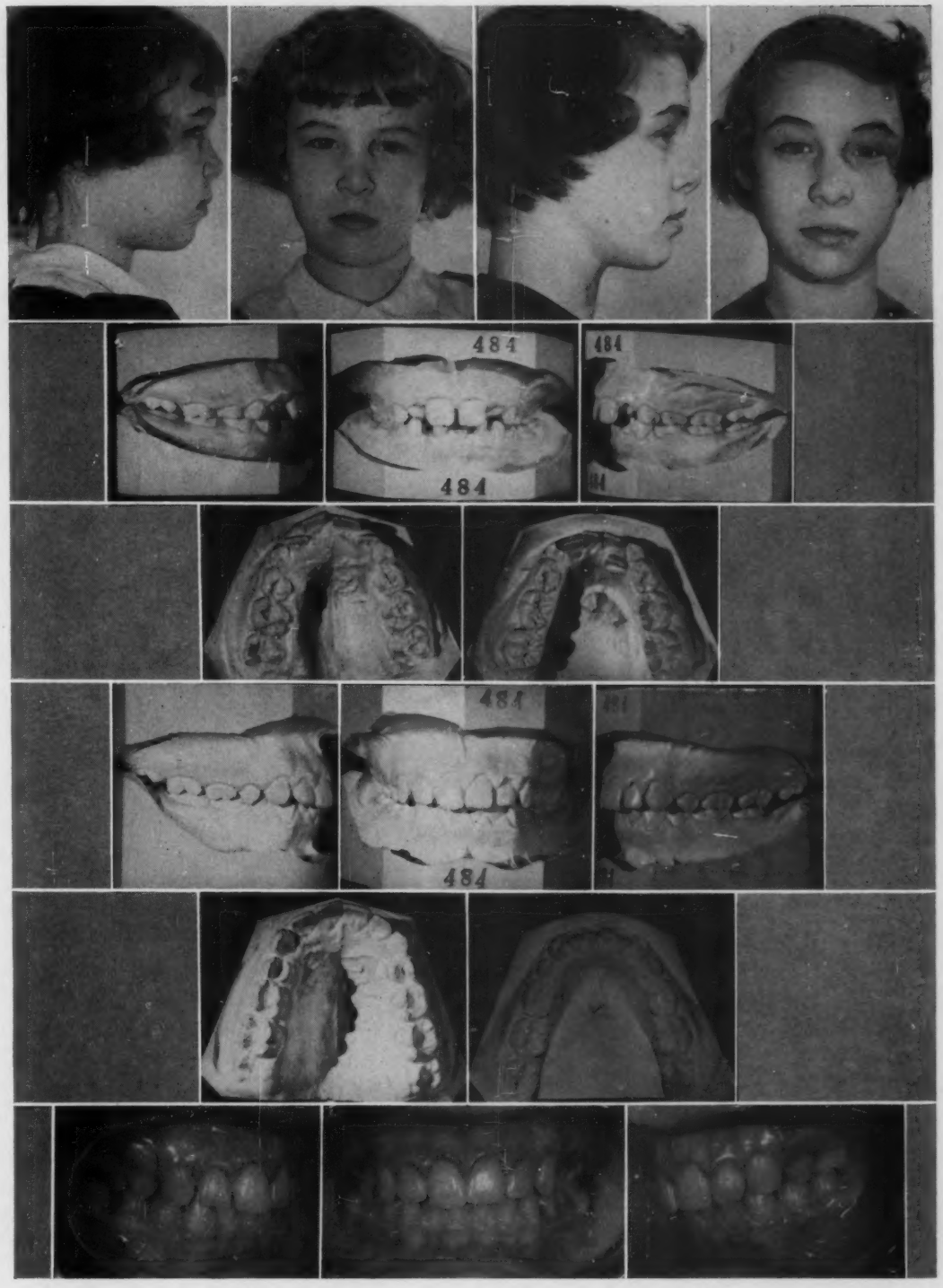


Fig. 2.—*A*, Photographs at start of treatment and three years ten months after removal of appliances. No secondary treatment. *B*, Casts at start of primary treatment, March 3, 1950, in a patient aged 7 years 7 months. *C*, Casts two years ten months after removal of appliances, March 17, 1954. Note maxillary lateral incisors. These teeth were not rotated, but positioned themselves after width was obtained. *D*, Photographs of teeth three years ten months after removal of appliances in March, 1955.

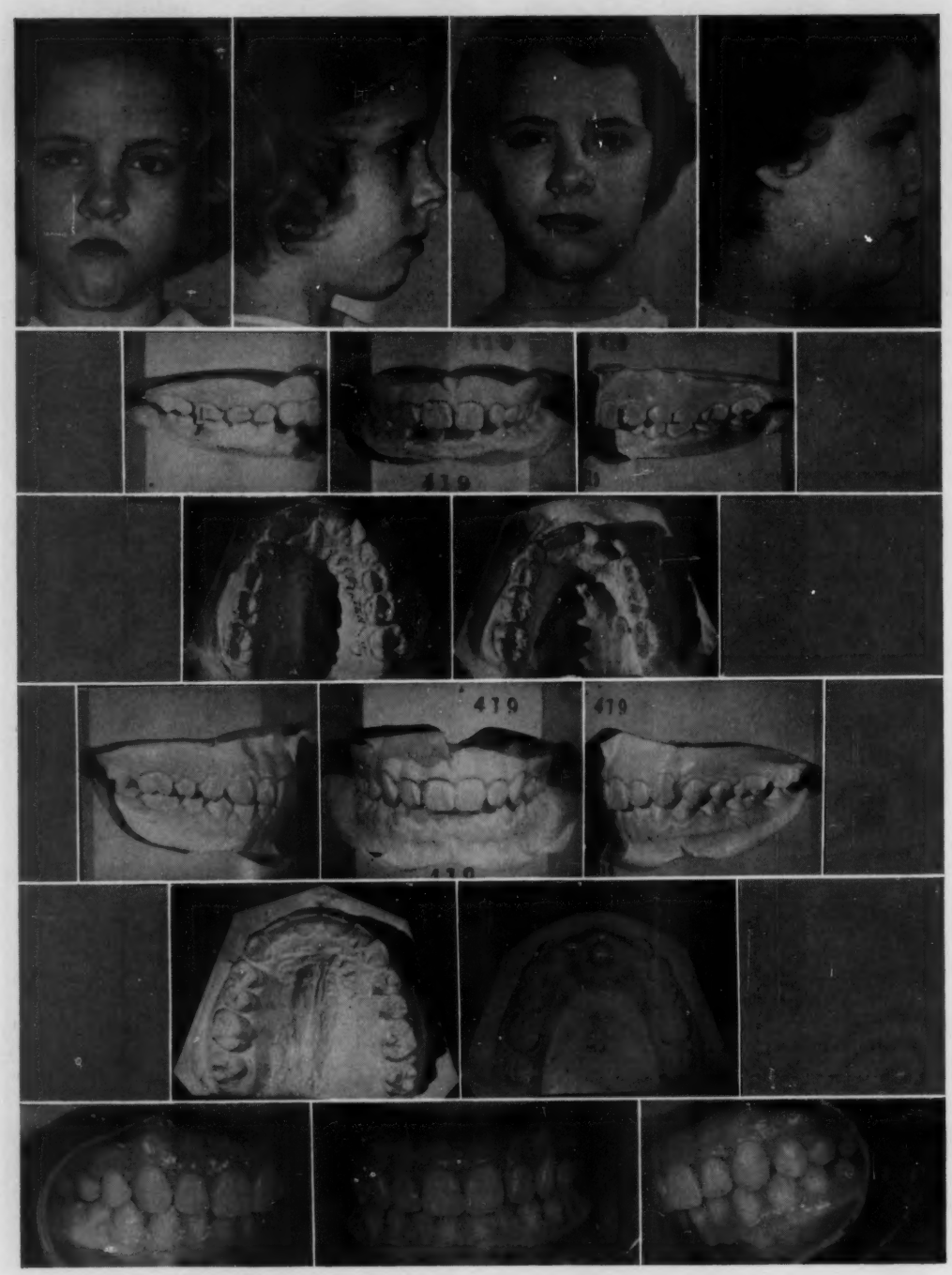


Fig. 3.—*A*, Photographs at start of treatment and eleven months after removal of retainers. *B*, Casts at start of treatment, Jan. 19, 1949, when patient was 8 years of age. *C*, Casts at end of retention, May 25, 1954. *D*, Photographs of teeth eleven months after removal of retainers, March 12, 1955.

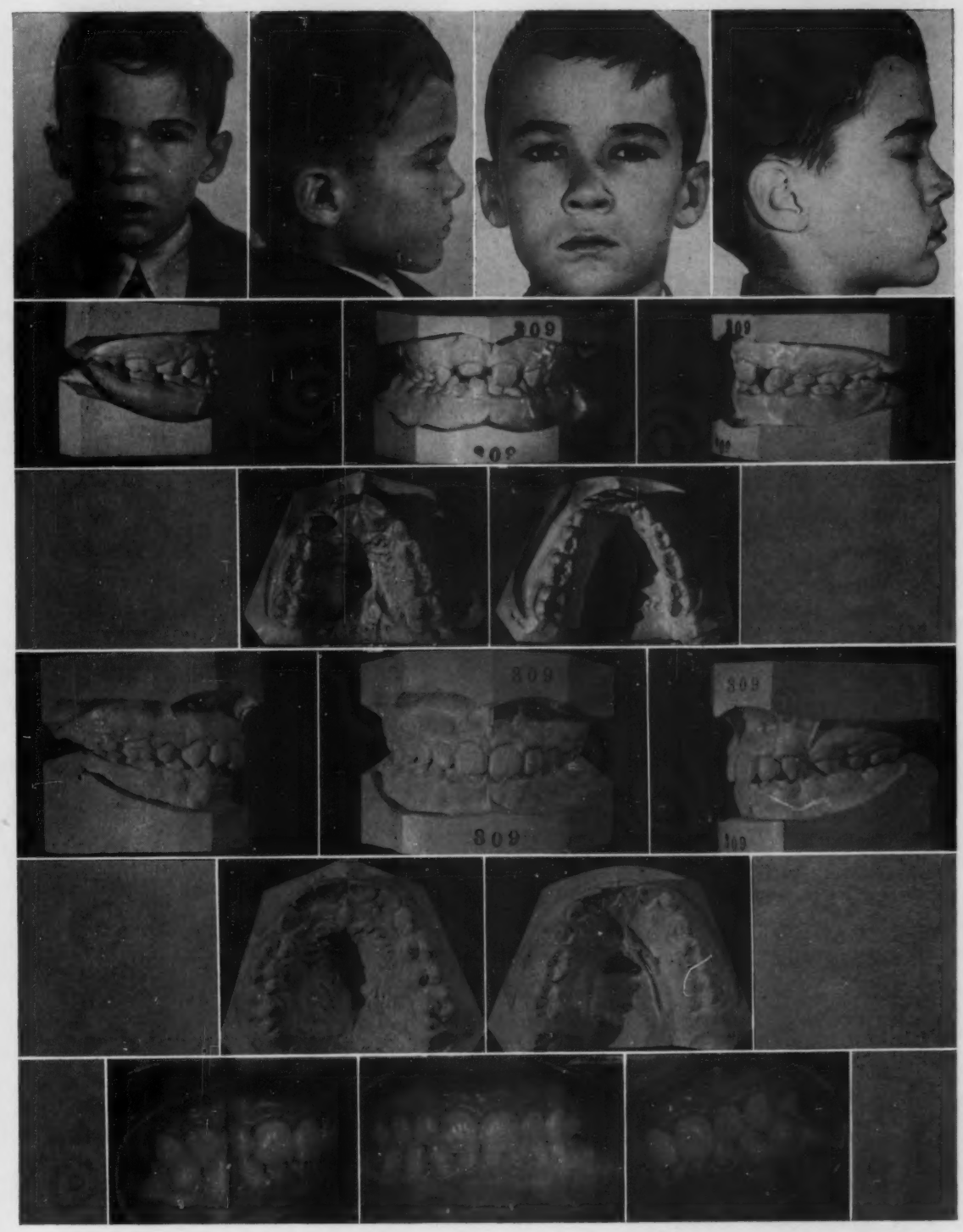


Fig. 4.—*A*, Photographs at start and at end of secondary treatment. *B*, Casts at start of treatment, Sept. 23, 1947, of patient aged 7 years 3 months. *C*, Casts at end of secondary treatment, Oct. 10, 1951. *D*, Photographs of teeth three months after removal of bite plate retainer, March 9, 1955.

and stone casts are poured. On each buccal segment the canine band is then connected to the molar band by soldering an 0.036 inch wire to each band, keeping the wire close to the gingival tissue and adjacent to the lingual surfaces of the one or two deciduous molars, as the case may be. This wire may be extended mesially from the canine resting against the cingulum of the incisors. Not only does this afford a little more stability to the arch, but it may correct some anterior rotations as the arch widens.

When the bands on each maxillary lateral segment are connected, we are then ready to solder the connecting lingual arch wire. This is of 0.040 inch round wire and is soldered to the lingual surface of the molar band; it then extends in a distal direction about one-fourth of an inch before being bent forward. The wire is carried just gingival to the band-connecting wire and, when opposite the deciduous canine, it is bent across the hard palate to the opposite canine, then in a distal direction past the molar band one-fourth of an inch, and bent back on itself to be soldered to this band. Care must be taken not to allow this wire to extend too far back in the mouth before it is recurved forward, as irritations to the soft tissues of the palate may result.

The mandibular appliance is constructed in the same manner except that the wire connecting the lateral segments is kept close to the gingival tissue lingual to the incisors and below the gingival border, but not too low to interfere with the soft tissues in the floor of the mouth wher the tongue is elevated.

When the activating part of the upper and lower appliances is completed, buccal tubes of 0.036 inch (inner diameter) are then soldered to the molar bands in case incisor rotations need attention later on with a labial arch wire. These tubes make removal of the appliance much easier, serving as lugs for the band remover plier to engage. Before cementing in the mouth, the appliance is heat-treated for three minutes to restore the optimum in resiliency and strength.

Being a reciprocal type of appliance, the adjustments are relatively simple. The lateral segments of the appliance are carefully expanded so as to increase the width from canine to canine and molar to molar about one-eighth of an inch. To obtain this expansion, the base or activating wire is bent at the curved portion of the wire that is just to the distal of its attachment to the molar band. This adjustment should be equal on both sides. This can be verified by carrying the appliance back to the cast from which it was removed. The appliance is then cemented on the teeth and all high spots are carefully spot ground. In three or four weeks the patient is seen in order to determine whether or not expansion has started, and usually some signs are evident. At the subsequent appointment, in from three to four weeks, the mandibular appliance is removed, arch width is checked against the appliance width and, if necessary, the appliance is expanded to keep the canine-to-canine and molar-to-molar band width at one-eighth inch greater than the corresponding tooth-to-tooth width. At the next appointment, in from three to four weeks, the maxillary appliance is removed, adjusted, and recemented. Subsequent adjustments are carried out on one jaw at a time so that adjustments to each

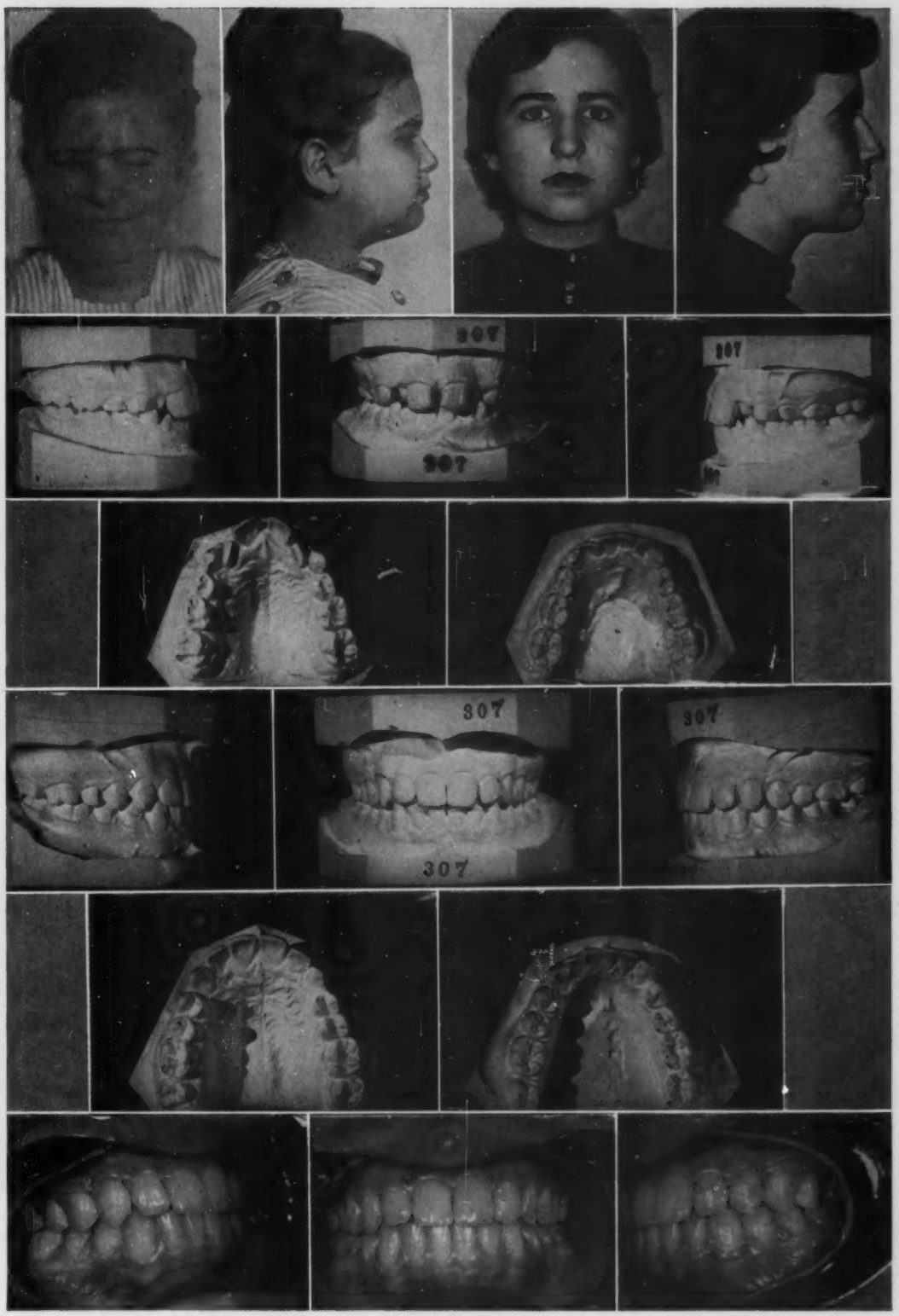


Fig. 5.—*A*, Photographs at start of treatment and three years after removal of retainers. *B*, Casts at start of treatment, June 8, 1948, when patient was 8 years 11 months of age. *C*, Casts one and one-half years after removal of retainers, July 1, 1953. *D*, Photographs of teeth three years after removal of retainers, March 5, 1955.

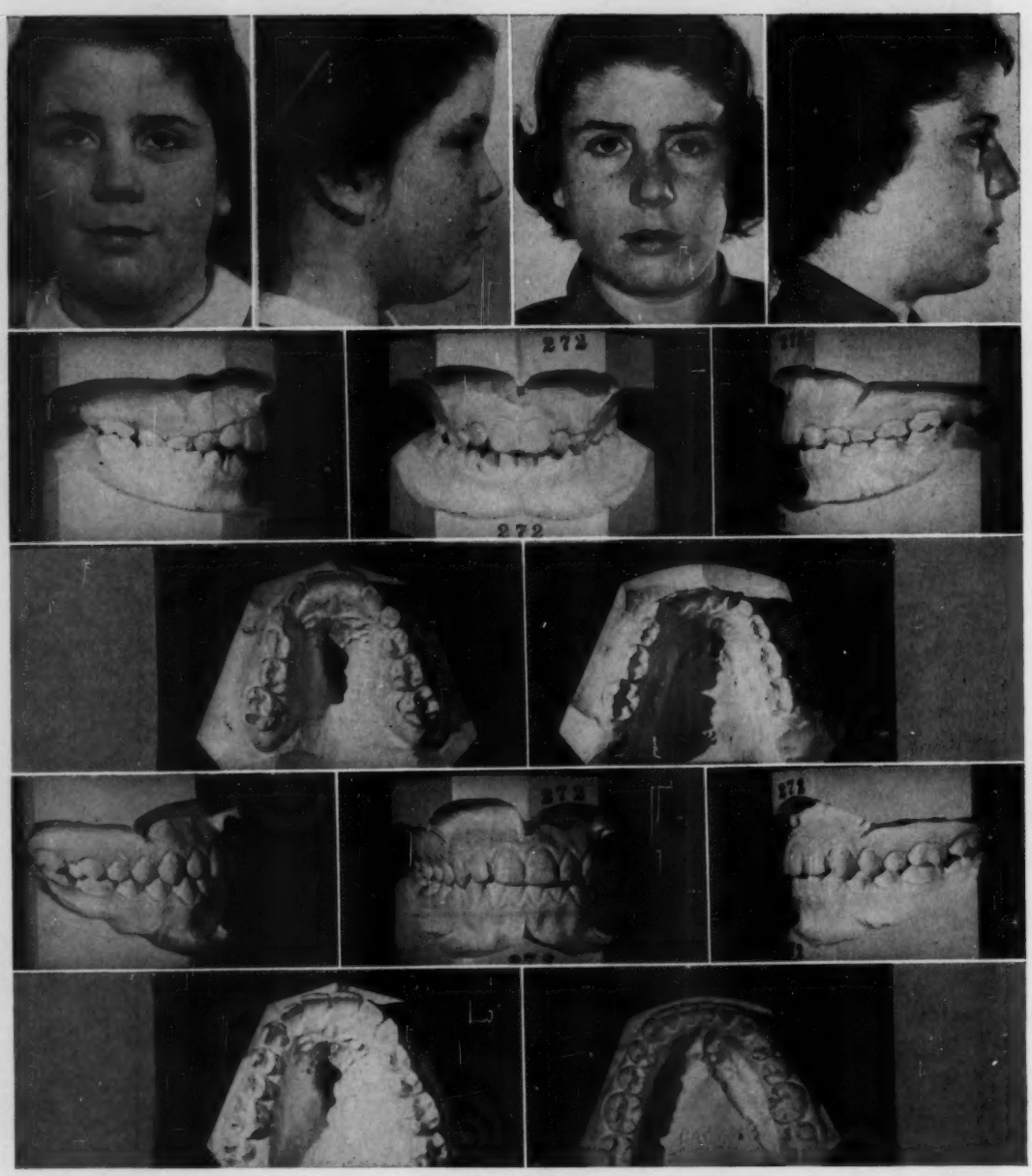
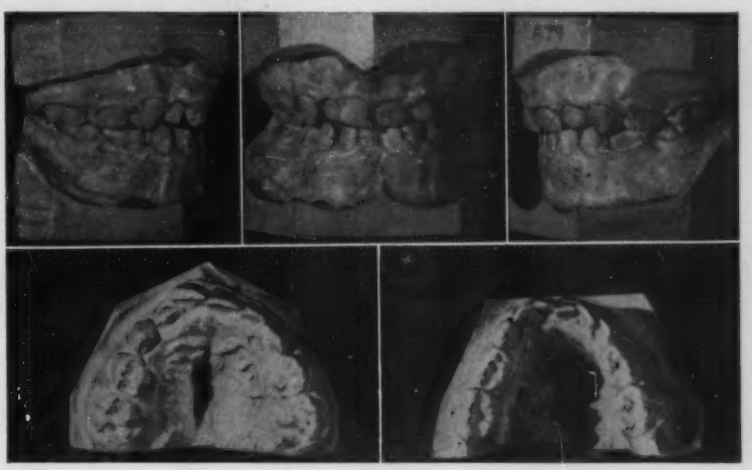


Fig. 6.—*A*, Photographs at start and at completion of treatment. *B*, Casts at start of treatment, Feb. 28, 1948. Note cross-bite on right side. The patient was 9 years 11 months old. *C*, Casts one year three months after removal of retainers, Sept. 27, 1952.

arch are not made more often than once every six weeks to two months. Usually the desired width can be obtained in from nine to fifteen months. The arch width is retained with the same appliance.

The desired arch width should be calculated carefully by the operator according to the mesiodistal widths of the six maxillary and mandibular



A.

B.

Fig. 7.—*A*, Casts at start of treatment, Oct. 26, 1938, when patient was 4 years 5 months of age. *B*, Casts made nine months after removal of retainers, March 31, 1949.

anterior teeth as derived from the x-ray pictures. Some overexpansion is desired, but within the limits of esthetics and good sense. The angularity that develops at the deciduous canine areas may be expected and irons itself out as the teeth are lost and the permanent successor errupts.

SUMMARY

By early expansion of the deciduous arches, many malocclusions can be prevented that otherwise would result in severe crowding of the anterior

teeth. Treatment as advocated here is not proposed as a panacea of all orthodontic crowding, but in a very high percentage of cases where obvious anterior crowding will be present, prevention of such anterior crowding may be expected.

A.

B.

Fig. 8.—*A*, Casts at start of treatment, Jan. 20, 1937, when patient was 6 years 2 months of age. *B*, Casts made three years after secondary treatment.

The success of early expansion of the deciduous arches is dependent on the availability of unabsorbed deciduous abutment teeth, and in the most successful expansion results, treatment was started in the second most active growth period, from 4 to 7 years of age.

The training of the musculature about and in the oral cavity probably has as much bearing on the success of early expansion as does any repositioning of the permanent developing teeth.

REFERENCES

1. Bogue, E. A.: Early Diagnosis, D. Mag. **3**: 69, 1908.
2. Lischer, B. E.: Early Treatment, D. Mag. **2**: 289, 1907.
3. Barnes, Varney E.: Irregularities Involving the Temporary Dentitions, D. Mag., pp. 1281-1284, December, 1906.
4. Sly, W. J.: Restoration of Functions Through Early Correction of Malocclusion, Am. J. Orthodontics and Oral Surg. **31**: 304, 1945.
5. Brodie, A. G.: The Fourth Dimension in Orthodontia, Angle Orthodontist **24**: 15, 1954.
6. Hawley, C. A.: A Study of Maxillary Movement, Dental Items Interest **34**: 426, 1912.
7. Anderson, George M.: Practical Orthodontics, ed. 7, St. Louis, 1948, The C. V. Mosby Company, p. 262.
8. Barnes, Varney E.: Expansion of Temporary Arches, D. Mag. **2**: 292, 1907.
9. Todd, T. W.: Integral Growth of the Face, Int. J. Orthodontia **22**: 321-334, 1936.
10. Subtelny, J. D., and Brodie, A. G.: Analysis of Orthodontic Expansion in Unilateral Cleft Lip and Palate, Am. J. Orthodontics **40**: 686, 1954.
11. Baker, Charles R.: The Selection of Cases for Treatment in the Deciduous Dentition, Am. J. Orthodontics **39**: 273, 1953.
12. Kloehn, Silas J.: A New Approach to the Analysis and Treatment in Mixed Dentition, Am. J. Orthodontics **39**: 161, 1953.
13. Ainsworth, George C.: Some Thoughts Regarding Methods and a New Appliance for Moving Dislocated Teeth Into Position, Int. D. J. **25**: 481, 1904.

638 Keith Bldg.

CASE SELECTION IN ORTHODONTIC MANAGEMENT DURING THE MIXED DENTITION PERIOD

WALDO O. URBAN, B.S., D.D.S., M.S., EVANSTON, ILL.

IT HAS long been known that from time to time in orthodontics there appear trends in the approach to treatment methods. What is not always noted is that these trends frequently follow research findings which disclose new and pertinent information. One of the newest implements of research in orthodontics is cephalometric radiography. Studies in this field over the past few years have established several facts which have had an important effect on case analysis and treatment techniques.

Serial cephalometric techniques have indicated that, in orthodontic treatment, teeth are moved over lesser distances than was generally supposed formerly, that excessive tooth movement which places teeth in positions which are intolerable to environmental musculature or "too far off their basal bones" is followed by relapse, and that cases which are successful by generally accepted standards are those which were treated during favorable growth periods. Cephalometric studies have indicated the relative constancy of skeletal pattern in the individual. A distinct advantage of using this aid is that the skeletal profile, the soft tissue profile, facial contour (convexity or concavity), and dental protrusion may be appraised more precisely. All these factors have a very important bearing on case analysis and treatment planning.

A recent trend in orthodontics is higher frequency of treatment in the mixed dentition stage. While many orthodontists have always treated cases in this stage, a substantial number have been accustomed to postponing treatment until all or nearly all of the deciduous teeth have been lost. A recent survey[1] has shown that "two mixed dentition procedures are currently favored by a majority of orthodontists. These procedures are (1) treatment of Class II malocclusions and (2) the procedure of serial extraction."

Figs. 1 and 2 show pretreatment and posttreatment denture casts of a patient who was treated in the mixed dentition stage. Although the patient's complaint was on the basis of esthetics, part of her problem was functional. The malocclusion was Class II, Division 2, which had settled into balance on the right side and was still developing on the left. In treatment the upper incisors were aligned and the first molar teeth were rotated and tipped back slightly.

From the Department of Orthodontics, Northwestern University Dental School.

Read before the Central Section of the American Association of Orthodontists, Des Moines, Iowa, Oct. 1, 1955.

The total treatment time was four months, after which time the appliance was removed and a palatal plate with a mildly inclined incisal plane was placed. This was worn for several months. In the treatment of this case no extraoral traction, elastics, or lower appliance were used. The second casts were made four years later. The patient was now 12½ years old and still

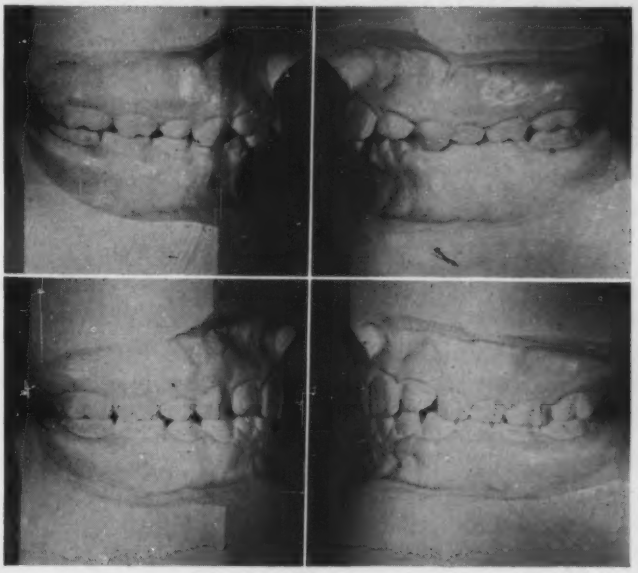


Fig. 1.—Patient B. B. Treatment time, four months. Second casts taken four years later. The patient still has eight deciduous teeth. No lower appliance was used.

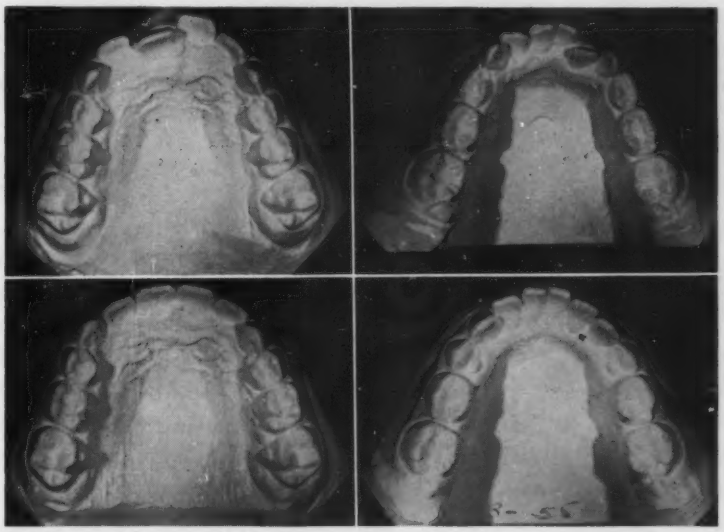


Fig. 2.—Patient B. B. Treatment time, four months. Second casts taken four years later. The patient still has eight deciduous teeth. No lower appliance was used. Note improvement in alignment of the lower incisor teeth.

retained eight deciduous teeth. The occlusal photographs show that there has been improvement in the lower incisor region, although no lower appliance was worn. This has been observed before and was recently pointed out by Brodie[2] in commenting on some of Kloehn's[3] and Nelson's[4] work.

While this case is unusual, it is, in my opinion, an example of an instance in which a short treatment period at this early stage brought about beneficial changes in esthetics and function which justified the treatment. While the child may need additional treatment at a later date, she is considered to be well within her individual normal range at this time.

In considering whether to treat a specific malocclusion in the mixed dentition stage, the orthodontist must decide not whether the patient has ideal conformation in dentures and face, but whether he is developing within his own individual normal age range. Minor discrepancies usually are not treated in Class I cases. Severe crowding and shortening of the dental arches frequently suggest serial extraction. Malocclusions with severe esthetic or psychological manifestations should be treated at any age.

Since cephalometric techniques have been introduced in their present state of refinement by Broadbent[5] and since cephalometric analysis has come into general usage, there has been an increase in the awareness of facial type. Several investigators, including Downs,[6] Thompson,[7] Reidel,[8] Fischer,[9] and others, have written in some detail about the importance of facial type and its effect on treatment planning. With the relative constancy of the skeletal pattern in mind, Reidel has stated that if, in dealing with protrusive cases, the orthodontist cannot change the skeletal pattern he can at least reduce the dental protrusion, and that it should be his aim to do so. Fischer, in discussing type, has said that normals in specific types of faces (for example, backward divergent faces) should be the models for treatment of malocclusions in the same type faces. This thinking is a departure from earlier concepts which held that the aim in treatment of all cases should be perfection in denture and face according to a standard norm. Thompson's teaching of functional analysis and Fischer's differential classification of Class II cases into functional and structural Class II have given impetus to the modern concept.

Schwartz,[10] writing on "The Norm Concept—Its Use and Abuse," has this to say: "We should stop comparing every face we see with some mental image that is pleasing to us or to one that has been set up by the compilation of a group of averages. This can only lead to disappointment because it has been shown that we cannot alter the basic pattern that presents itself for treatment." He quotes Fischer: "Any standard that is formulated either ideally or upon the basis of a statistical norm casts all individuals into a preconceived anatomic, functional or esthetic mold and ignores the individuality of the facial complex." Schwartz continues: "The configuration of the malocclusion represents a state of equilibrium between the various forces which play upon the denture. The pressure of the tongue and lips, the action of the inclined planes of the teeth, the forces of growth and development—all these move the denture elements until a point of equilibrium is reached. Any attempt to change this configuration disturbs the equilibrium, and with the removal of the force, the system tends to return to its original position."

Standard norms do, of course, have value. An example of this may be found in the management of protrusive cases. If, before treatment, the den-

tures are in protrusion beyond normal range, then in treatment the orthodontist must not increase this protrusion, but should strive to reduce it. The same rule applies inversely to retrusive cases.

In applying the individual normal concept to the treatment of Class I cases, serial extraction of teeth seems to be justified in selected cases, and here cephalometric evaluation is helpful. Serial extraction has been described in some detail by Kjellgren[11] and, more recently, by Dewel.[12] If, on the basis of reliable diagnostic techniques, it is decided that a patient may not retain all his teeth and have them straight without causing unacceptable increase in the dental protrusion, and if this decision is reached when the patient is in the mixed dentition stage, then it will be to his advantage to begin a serial extraction program promptly. In many of these cases the deciduous cuspid teeth may be lost "prematurely." Dewel has pointed out that early loss of these teeth, frequently charged with being the cause of malocclusion, actually may be the result of insufficient growth of the supporting bones. Hellman long

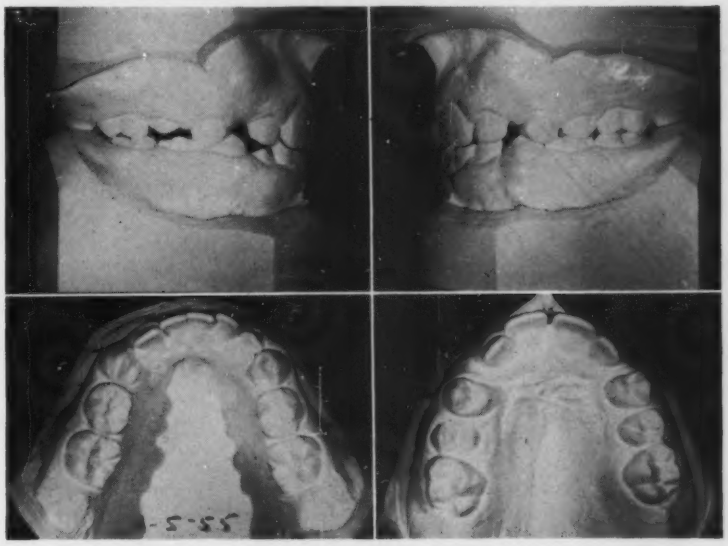


Fig. 3.—Patient S. M. This case has received no appliance therapy up to this time. The treatment plan will include the removal of the four first premolar teeth.

ago commented on the fact that in cases of premature loss of deciduous teeth by caries or other cause it was sometimes necessary to maintain the space mechanically and sometimes not. Premature loss of deciduous teeth, then, with space closure may be a valuable clue to orthodontic management.

Patients S. M. and R. L. represent two similar types which are not treated by me in the mixed dentition stage, except that the loss of the deciduous teeth is observed, and if the order or time of natural loss is not satisfactory this is managed.

In the case of S. M. it was decided early that it would be to the patient's advantage to have some adult teeth removed as part of the orthodontic management. The deciduous teeth, except the lower second molars were shed

naturally. The spaces for the cuspid teeth were pretty well closed. On the basis of cephalometric measurements, it does not seem logical to increase the facial convexity or the dental protrusion. The upper and lower incisors are tipped back somewhat as compared with normal mean measurements, but this is to be expected and is desirable with the NS-GoGn angle of 43 degrees.

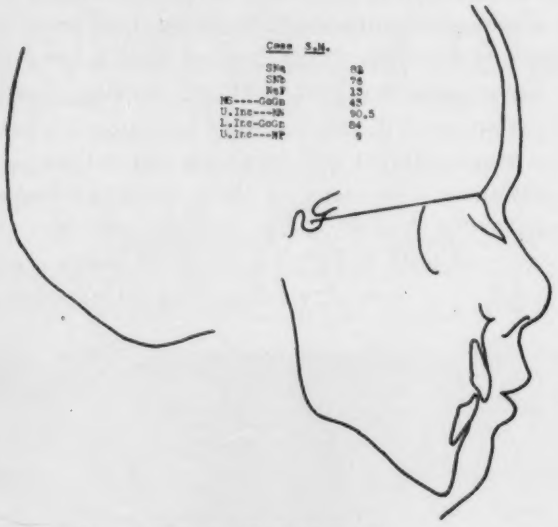


Fig. 4.—Patient S. M.

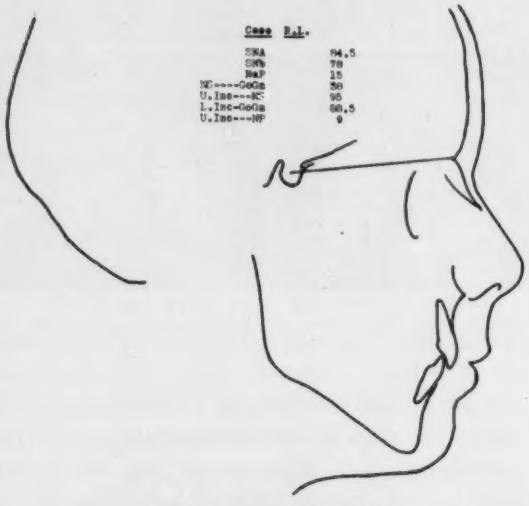


Fig. 5.—Patient R. L.

Tipping these teeth forward would increase the dental protrusion, which is already excessive at 9 mm. The angle of convexity is high at 13 degrees. Orthodontic treatment of this case from this point forward will include the extraction of the four first premolar teeth. Cases of this type are not treated by me in the mixed dentition stage except that the loss of the deciduous teeth is supervised until the time when extraction of some adult teeth is indicated.

Patient R. L. represents another type which, in my practice, is not treated in the mixed dentition stage, except that the loss of teeth is supervised and managed. This case is similar to the previous one except that the lower second premolars are congenitally absent. The angle of convexity, at 15 degrees, is rather high. The upper incisor teeth are tipped back slightly, which is to be expected in cases with a 38 degree NS-GoGn angle and a 6½ degree aNb angle. Because of the denture base relation (SNa-SNb difference of 6½ degrees), it would seem desirable to see the lower incisor teeth tipped forward somewhat. This case is complicated, however, by the congenital absence of the lower second premolar teeth, and it was decided to extract the lower second deciduous molars early and to allow the spaces to close. In order to balance the dentures mesiodistally, the upper first premolar teeth were also removed. Subsequently, the spaces have partially closed by natural forces, as may be seen by viewing the second casts. The case is now ready for appliance therapy.

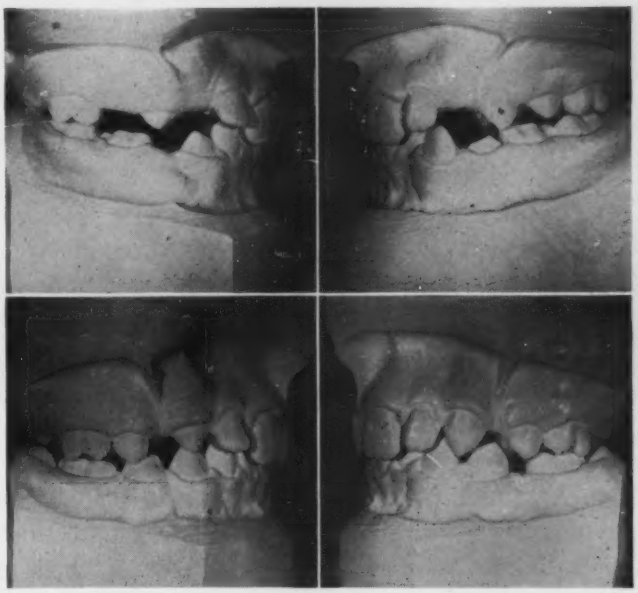


Fig. 6.—Patient R. L. This case has received no appliance therapy up to this time. The right and left lower second premolar teeth are congenitally missing. The lower second deciduous molars and the upper right and left first premolar teeth were removed. The case is now ready for appliance therapy.

In this case, as well as in the case of patient S. M., appliance therapy is not urgent in the mixed dentition period because there is no immediate esthetic or functional problem and the removal of some adult teeth is anticipated. Although in both of these cases the facial convexity and the dental protrusion measurements are high, the soft tissue profiles are acceptable. It is considered, however, that if patient S. M. is allowed to develop under natural influences and is finally treated on a nonextraction basis, the dental protrusion will become intolerable.

In patient R. L. the determining diagnostic factor in electing to extract teeth and close the spaces in the orthodontic management of the case was the congenital absence of the lower second premolars.

The case of patient L. B. is similar to the two previous cases in that, on the basis of cephalometric analysis, it seems to fall into a serial extraction classification. In this case, however, there is an urgent esthetic and functional problem. As may be noted from the pretreatment tracing, the patient is able to close the lips only with considerable strain. In repose the lips are apart. The angle of convexity (10 degrees), the dental protrusion (15 mm.), and the upper incisal angle (112 degrees) suggest that in treatment the dental protrusion should be reduced considerably and that the prognosis seems unfavorable unless, in the course of treatment, some adult teeth are removed.

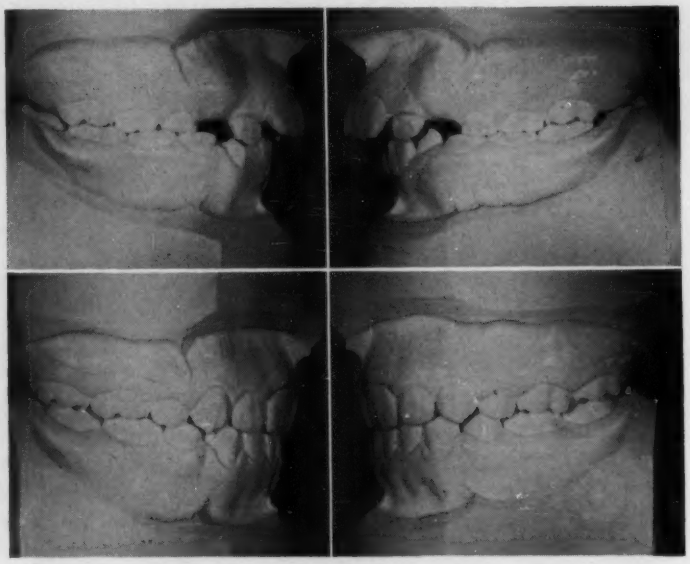


Fig. 7.—Patient L. B. Management included serial extraction and early appliance therapy.

In the management of this case the upper and lower first deciduous molar teeth were extracted. As soon as the first premolars began to erupt they were removed also, and lingual holding appliances were placed in both arches. When the cuspid teeth had erupted far enough for the placement of attachments, their distal retraction was started. At this time the upper arch was reinforced with extraoral traction. From this point forward, the treatment was accomplished with the aid of a full-banded appliance which is standard in my practice. In retention, a rubber positioner was used. The results of treatment are shown by the posttreatment casts and cephalometric tracings. The reduction in the angle of convexity (4 degrees), the reduction of the axial inclination of the upper incisor (20 degrees), and the reduction in the dental protrusion (10 mm.) are all favorable changes which contribute to a general improvement in the profile. These changes are attributable to orthodontic tooth movement plus growth. The constancy in the SNa-SNb difference (about 5 degrees) indicates that the improvement in the profile received no contribution from forward positioning of the mandible. The angle of inclination of the

upper incisor in the posttreatment measurement (92 degrees) is desirable in the presence of the 38 degree mandibular base plane angle and the 5 degree aNb angle.

In applying the individual normal concept to Class II malocclusion, one must consider that in functional Class II one may treat the lower denture to the upper; in structural Class II one must treat the upper denture to the lower, even though the mandible may be distal to optimum position. In the former case the skeletal profile may be straightened in the course of orthodontic treatment, and this is within the patient's hereditary potential, for the distoclusion is functional. In the latter, straightening the skeletal profile is not within the patient's hereditary potential. The distoclusion is structural and not functional, and no improvement in mandibular posture can be expected. In this type of case, extraction of some teeth from the upper arch

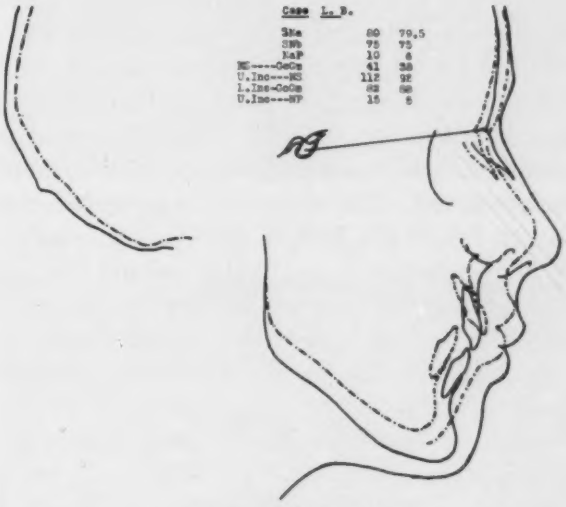


Fig. 8.—Patient L. B.

may be indicated in some instances, and by this method the dental protrusion may be reduced sufficiently to cause a marked straightening of the soft tissue profile. Fischer[9] points out in some detail, however, an important fact—that most cases are not pure types, and that the great majority lie somewhere between the extremes, purely structural and purely functional Class II.

In my management of Class II cases during the mixed dentition period, intermaxillary elastic traction is not ordinarily used. This is because, in my judgment, since it is relatively easier to move teeth mesially than distally, the lower denture is in many cases moved forward off the supporting base bone by this therapy into an intolerable position and this is followed either by an increase in the protrusion or (in the presence of good muscle tone in the lips) by recoil resulting in crowding in the anterior section. If unacceptable crowding already exists in the lower arch before treatment, the case quite possibly

requires the removal of some teeth in the course of treatment. In general, the arches may be expanded only to the extent of uprighting lingually tipped teeth. However, incisor inclination in relation to the mandibular base plane should always be correlated with the mandibular plane-cranial base angle and with the denture base relation.

In my practice, an impressive percentage of Class II cases which are seen in the mixed dentition stage present lower dental arches which are acceptable in length, width, and form, or by commonly accepted methods it can be demonstrated that, upon the exchange of buccal deciduous teeth for adult teeth, the arches may be expected to become acceptable. In the management of this type of case it is standard practice to employ an upper appliance, usually consisting of bands on the incisors and first molars, a sectional arch wire, and an accessory assemblage for extraoral traction. In these selected cases no lower appliance is used. Patients S. K. and A. L. were treated by this method.

The degree of success in treatment of this type of case at this age level should be measured not on the basis of exquisite detail in tooth position, but according to whether or not the upper incisor protrusion has been reduced and the denture relation is Class I at the end of the treatment period. It should be expected that some of these cases will require an additional course of treatment and that others will not. The prognosis is more favorable if the mandibular plane is relatively flat, if the growth direction is less downward than forward, and if there is evidence to indicate that during the course of treatment there will be a spontaneous forward positioning of the mandible. Extraoral techniques frequently have been appraised on the basis of whether or not molar teeth have been moved distally in relation to a selected cranial plane. This may be misleading, for it has been demonstrated by serial cephalometric techniques[13] that the favorable changes which accompany treatment of selected cases by this method are due partly to tooth movement, but mostly to growth and to favorable changes in mandibular posture. All these factors contribute to the improvement in the facial profile.

As the mandible grows in the region of the condyle, the body moves along the path that is established for the individual, usually downward and forward. If the occlusion is well locked in Class II interdigitation, it seems reasonable to suppose that in untreated cases each time the mandible is brought into occlusal contact with the maxillae through the cuspal interdigitation of the teeth, the mandible may, as it moves forward, drive the maxillary denture forward with it and the Class II relation will be maintained. Usually abnormal lip posture contributes to this. Spontaneous correction of Class II is rare, but it has been reported. The cases in which this has happened are limited to those in which a thumb habit, or another abnormal muscle habit which has held the mandible in a position of distal displacement, has been discontinued, or those cases in which occlusal interferences which have held the mandible in this distal position have been removed either by appliance therapy or by occlusal equilibration.

In 1935 Rogers[14] reported cases in which this favorable change occurred. His treatment included the removal of dental interferences by appliance therapy, followed by a carefully supervised program of myofunctional therapy.

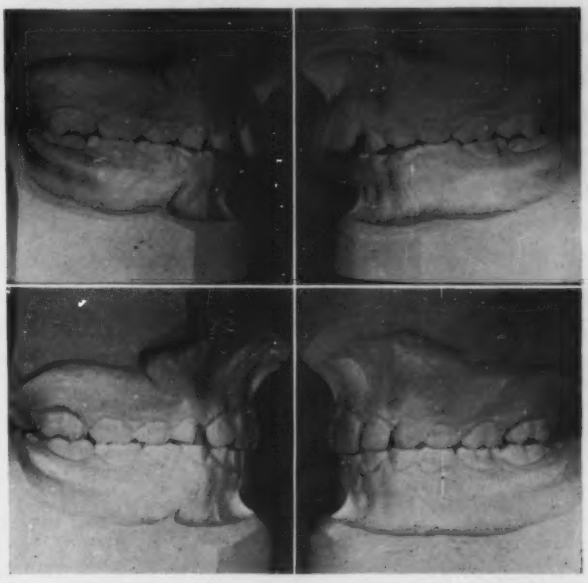


Fig. 9.—Patient S. K. Treated with upper appliance with extra-oral traction. No lower appliance was used.

Fig. 10.—Patient A. L. Treated with upper appliance with extra-oral traction. No lower appliance was used.

Some of these reports were accompanied by serial radiographs of the temporomandibular joint region which showed that the condyles, at the beginning of the myofunctional program, occupied positions downward and forward from their original (Class II) positions when the teeth were placed in occlusion in normal

(Class I) relation; but at the end of the program, with the distoclusion corrected, the condyles were again in normal positions in their fossae. The same thing has been demonstrated more recently by Terry.[15] This must be accounted for by growth and/or the release of a distal displacement, and points up in a graphic manner the important role which growth and function play in the success of treatment.

When, in cases of this type, the Class II interdigitation is disturbed by the use of an upper appliance activated by extraoral traction, the upper arch is "held back" as the mandible grows forward (and in some cases as it adjusts forward) to assume a better postural position. These patients are instructed in simple posture exercises. These consist mainly in standing before a mirror with feet slightly apart and hands at sides. The finger tips are pushed downward and the chest is raised by asking the patient to elevate the clavicles, to inhale and to "stand as tall" as possible. This exercise is continued intermittently with rest periods for ten minutes twice daily. In almost every instance, when the patient assumes this posture the lips close and air is taken in through the nose. In the small percentage of cases in which this does not happen the patient is instructed to close the lips and to breathe through the nose. Usually the patient is enthusiastic about this exercise and is willing to practice it; the parent is anxious to help him remember. The purpose of this procedure is to improve general posture, especially the posture of the mandible, and to encourage normal lip function and respiration. At this time he is told that proper lip posture will aid in the correction of his malocclusion and in the retention of the case.

In the management of these cases, usually the upper incisor teeth are banded. Spaces are closed and minor rotations are corrected. It is important to determine the positions of unerupted cuspid teeth in order not to move the incisor roots against these unerupted crowns. When the case is thought to be within the patient's individual normal range, the treatment appliance is removed and a palatal plate is placed. This usually has a labial wire against the incisors, which is removed after a period of a few weeks. Into the plate is built an incisal guide plane or bite plane which is inclined upward and forward. In treating cases by this plan, the degree of success is influenced greatly by the growth increment during treatment. It is not possible usually to determine definitely when a patient will grow. If good growth is experienced during treatment, the degree of success is greater than if growth is slight. The use of an inclined plane in conjunction with the palatal retainer may, in some instances, hold the mandible forward temporarily beyond the patient's growth potential. If the patient "grows into" this pattern the condyles will, through this growth, again assume a good relation to their fossae. If growth does not continue in sufficient degree to accomplish this, the mandible will return toward its former distal position when the plate is removed. In the meantime, the reduction in the horizontal overjet, the improved lip function, and nasal

breathing will have contributed to a reduction in the distoclusion. If growth has been inadequate, the case may now require a second course of treatment. This frequently involves the removal of one pair of teeth from the upper arch. If normal unerupted third molars are present, the second molars ordinarily are removed.

Boman,[16] in reviewing the results of research by a number of investigators, said, "It is apparent that in order to correct a Class II, Division 1 maloclusion in a satisfactory manner, mandibular growth must occur during the period of active treatment. This is the growth hypothesis and the orthodontic profession has been informed of this fact many years ago in the writings of Milo Hellman and B. Holly Broadbent."

Patient A. W. was treated by the use of an upper appliance activated by extraoral traction. The casts and cephalometric tracings indicate the changes which were associated with treatment. The tracings indicate that orthodontic tooth movement, slight forward positioning of the mandible, and mandibular growth have all contributed to the improvement in this case, the

Fig. 11.—Patient A. W. Treated with upper appliance with extraoral traction. No lower appliance was used.

greatest contribution having been made by growth. Although this patient may need additional treatment at a later date, he is considered to be well within his individual normal age range at this time and the prognosis seems good. The treatment time was seventeen months.

Unless the orthodontist is willing and able to control completely with his appliance all the movements of the teeth during the treatment period, including movement influenced by growth, eruption, and function, by the tongue, the lips, and the cheeks, and by occlusal contact, in speech, in mastication, and in swallowing, he must then design his appliance to interfere as little as possible with the normal physiologic forces during this period. Treatment should not

be longer than is necessary to place the patient within his individual normal range in space and time. In many cases treatment should be intermittent. Ordinarily the orthodontist sees a patient over a relatively long period of time—in observation, treatment, and retention. It should not be expected that he should be able to treat every individual once and for all time in one course of treatment.

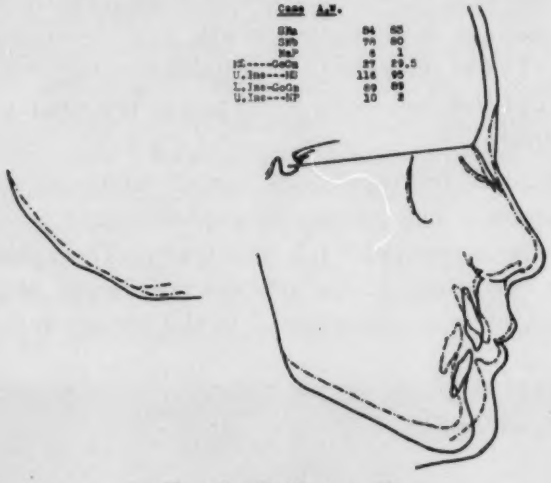


Fig. 12.—Patient A. W.

Malocclusion is not a specific malady which responds to a specific treatment technique. The sum total of the orthodontist's knowledge, wisdom, judgment, and clinical skill will be reflected in his day-to-day patient management. As a scientist, he must continually re-examine his concepts in the light of new knowledge. His clinical efforts to assist his patients in progressing from the abnormal to the normal will always be modified by the patient's potential, by the orthodontist's concept of the individual normal, and by his hypothetical ideal.

REFERENCES

1. Germond, Robert C.: A Survey of Current Practice Procedures, AM. J. ORTHODONTICS **41**: 506-525, 1955.
2. Brodie, Allan G.: The Fourth Dimension in Orthodontia, Angle Orthodontist **24**: 15-30, 1954.
3. Kloehn, S. J.: Guiding Alveolar Growth and Eruption of the Teeth to Reduce Treatment Time and Produce a More Balanced Denture and Face, Angle Orthodontist **17**: 10-33, 1947.
4. Nelson, Beulah: What Does Extraoral Anchorage Accomplish? AM. J. ORTHODONTICS **38**: 422-434, 1952.
5. Broadbent, B. Holly: Measurement of Dentofacial Changes in Relation to the Cranium, in Dewey, M.: Practical Orthodontia, ed. 5, St. Louis, 1935, The C. V. Mosby Company, pp. 184-204.
6. Downs, W. B.: Variations in Facial Relationships; Their Significance in Treatment and Prognosis, Angle Orthodontist **19**: 145-155, 1949.
7. Thompson, John R.: The Rest Position of the Mandible and Its Significance to Dental Science, J. Am. Dent. A. **33**: 180, 1946.
8. Reidel, Richard: Esthetics and Its Relation to Orthodontic Therapy, Angle Orthodontist **20**: 168-178, 1950.
9. Fischer, Bercu: Treatment of Class II, Division I (Angle). III. Variation and Individuality Hypothesis, Angle Orthodontist **20**: 116-134, 1950.

10. Schwartz, Harold: The Norm Concept—Its Use and Abuse, Angle Orthodontist **23**: 138-141, 1953.
11. Kjellgren, Birger: Serial Extraction as a Corrective Procedure in Dental Orthopedic Therapy, Acta odont. scandinav. **8**: 17-34, 1948.
12. Dewel, B. F.: Serial Extraction in Orthodontics; Indications, Objectives and Treatment Procedures, AM. J. ORTHODONTICS **40**: 906-926, 1954.
13. Urban, Waldo O.: A Cephalometric Radiographic Study of Some of the Changes Associated With Orthodontic Treatment of Selected Cases of Malocclusion Using Upper Appliance With Occipital Anchorage, Angle Orthodontist **25**: 61-76, 1955.
14. Rogers, Alfred Paul: The Behavior of the Temporomandibular Joint in Response to the Myofunctional Treatment of Malocclusion, INT. J. ORTHODONTIA **21**: 426, 1935.
15. Terry, H. K.: Cases Indicating Early Treatment, AM. J. ORTHODONTICS **41**: 279-290, 1955.
16. Boman, Vernon R.: Research Studies on the Temporomandibular Joint; Their Interpretation and Application to Clinical Practice, Angle Orthodontist **21**: 154-164, 1952.

DIAGNOSIS AND TREATMENT WITH OCCIPITAL ANCHORAGE

WALTER H. MOSMANN, D.D.S., HACKENSACK, N. J.

IN THIS article on diagnosis and treatment with the use of occipital anchorage, I will attempt to summarize my clinical concept and cephalometric findings regarding the treatment of Class II, Division 1 and Division 2 malocclusions.

The exclusive use of occipital anchorage in carefully selected cases will bring satisfactory results if the following conditions exist:

1. Cases of Class II malocclusion with the maxillary incisors either protruding, retruding, or crowded.

2. The mandible must be in such relationship to cranial anatomy that the mandibular plane, if extended posteriorly, intersects or falls below the occipital bone. There must be excellent alignment of mandibular teeth or else ample space for them to erupt into good alignment. There may be an excessive curve of Spee and there may be slight spacings, but there should be no rotations or overlapping of contacts. The incisor-mandibular angle should not exceed 95 degrees.

If fillings have been inserted which do not maintain the normal mesiodistal width, or if deciduous teeth have been prematurely lost, then a forward drifting of the mandibular first molars may shorten the arch length and good occlusion cannot be obtained with headcap treatment.

3. Active facial growth, during treatment, is essential. I like to start these patients just prior to the accelerated growth period which frequently occurs in girls around 10 and in boys around 11 years of age. These are only approximate ages, depending upon the physical development of the child. The question may arise as to why the headcap is not started sooner during an earlier growth period. The reason for this is that I feel that it is difficult to foretell whether the mandibular teeth will develop into proper alignment. I would like to caution the reader that only approximately 10 per cent of my patients will meet the conditions mentioned.

After experimenting with the various types of headcaps and attachments, the present headcap was evolved. This headcap has been worn without discomfort by my patients for periods ranging from a few months to more than two years. It does not shift, nor does it come off during sleep; it does not cause irritation to the lips or cheek. It controls the direction of pull ac-

Read before the Northeastern Society of Orthodontists, Buffalo, New York, Oct. 26, 1954.

curately, which is very important. It also affords a continuous pull regardless of the position of the patient. These factors encourage patient cooperation.

Following the study of the models, cephalometric and intraoral x-rays, and the decision to try headcap treatment, ample time is reserved for a full and free discussion with the parents and the patient.

Please note that I say "try" headcap treatment. While much depends on the presence of satisfactory growth factors, a great deal depends upon the understanding, interest, and compliance of the patient. After all, he is going to carry out the treatment prescribed.

This point needs emphasis. A youngster who is a good Boy Scout or Girl Scout, one who has a sense of team spirit and who will pitch in and help when asked to assist, will also become a good headcap patient.

These character traits should be probed and those of the parents should be considered also. Most of the orthodontic treatment is done by the patient, in the privacy of his own home. It is essential that he be interested and willing. If patient, parent, and orthodontist have mutually decided to undertake headcap treatment, at the close of this discussion period another appointment is made to fit the headcap.

As may be imagined, not every patient exhibits this ideal attitude and frequently I recommend a trial period of varying length, usually three months, during which the patient is carefully checked regarding compliance. If the progress has been unsatisfactory at the end of this trial period, then there is another consultation among parents, patient, and orthodontist. If patient cooperation has been unsatisfactory, treatment may be discontinued completely. If cooperation has been good but lack of growth is suspected, treatment may be temporarily discontinued pending commencement of an active growth period. Sometimes it is necessary to have a longer trial period with the headcap in order that this growth factor can be definitely determined.

The parents are not permitted to be present during the fitting of the headcap mechanism. This policy has a psychological basis, namely, that it is important that the orthodontist delegate sole responsibility directly to the patient during the fitting process.

Headcaps are made up in advance in five headband sizes. There are two straps running over the crown of the head and intersecting at the vertex, one running anteroposteriorly and one bilaterally. These straps are made sufficiently long to fit any patient. There are two other sets of straps which are sewed to the headband—one vertically downward, midway between the ear and the corner of the eye, and the other sewed at the posterior portion of the headband at an angle so that it may run forward along the side of the cheek.

After a headband of the proper size has been selected and placed upon the patient, the straps that run across the crown are tucked and sewed so that the headband and the crown straps are snugly adapted to the head. The right and left posterior straps are pulled forward below the ear and are lined up with the occlusal plane of the teeth. The two vertical anterior straps are now pinned to the horizontal posterior straps.

The plastic cheekpiece is placed upon the posterior strap about one inch posterior to the chelion. Care must be taken to have the center line of the plastic cheekpiece in line with the occlusal plane. The outline of the cheekpiece is marked on the strap with a white pencil. The headcap is removed and the assistant stitches the two straps together and sews the plastic cheekpieces on.

The first maxillary molars are separated in order that bands may be constructed. At the next visit, molar bands are adapted to the maxillary first molars and an impression is taken with the bands in place. The bands are removed and inserted in the impression, a thin layer of wax is placed on the lingual surface of the buccal portion of the bands, and a plaster cast is made. Buccal tubes (0.036 inch) are soldered, with care being exercised to see that they are parallel to the occlusal plane. An 0.036 inch labial arch wire is constructed. Adjustable loop stops (0.030 inch) are placed mesially to the buccal tube and an outer face-bow of 0.040 inch is soldered to the labial arch.

At the next visit, molar bands are cemented. After the loop stops are adjusted to the anterior portion of the arch wire, it should be 2 mm. forward of the maxillary incisors.

Next, the patient stands in front of a wall mirror and, with the help of the dental assistant, practices placing and removing the headcap and arch wire mechanism.

After he has thoroughly mastered these steps, the parents (or parent) are invited in to witness him demonstrate the procedure. This also tends to establish a desirable psychological relationship between the patient and the parents with respect to his pre-eminent knowledge of the appliance. He needs no outside assistance when inserting it. He is self-reliant. He does not ask questions of his parents about the headcap; he answers theirs.

Cooperation in my office is usually mentioned only at the beginning of treatment and after that it becomes a matter of patient management.

The patient is always strongly cautioned against failure to wear the appliance by pointing out that by missing one night, he will undo all the progress achieved during the past seven nights. Or, the situation may be likened to a youngster who lets go of a sled while pulling it uphill and as a result has to go down to the bottom and start all over again.

Following this demonstration to the parents, the appliance is inspected. The patient is told to keep a written record of the number of hours in each twenty-four in which he wears the headcap. This is always reported at each visit to the assistant and, in his presence, she makes a notation on a permanent record.

The patient's progress is checked at three-week intervals until a Class I relationship is obtained. At this point, the loop stops are removed so that the arch wire can exert pressure on the incisor teeth and move them lingually, thereby closing spaces. When the occlusion is satisfactory, final records, in-

cluding a cephalometric x-ray picture, are taken. A comparative study of these records leads to the following conclusions:

1. Headcap treatment strongly retards the forward movement of the maxillary teeth, despite the manifestation of active dentofacial growth.

2. Mandibular teeth are carried forward into Class I relationship during headcap treatment as the mandible grows forward and downward.

3. Distal movement of maxillary molars is extremely rare, having been noted in only two out of approximately fifty headcap cases, and at that the distal movement was less than 1 mm. This lack of distal movement was noted in the comparison of the "before and after" cephalometric tracings.

4. It is also essential that the mandibular teeth be in good alignment or that ample room exist for them to erupt in good alignment.

5. The mandible should be in satisfactory relationship to cranial anatomy. This can be determined by drawing a line tangent to the inferior border of the mandible running toward the cranium. If this line intersects or falls below the base of the occipital bone, the prognosis for headcap treatment is favorable.

6. The headcap must fit very accurately, as previously described, in order to control the direction and amount of force applied.

7. The headcap should be easy for the patient to put on and remove and it should be comfortable to wear.

8. The continued cooperation of the patient in wearing the headcap mechanism should be stressed forcefully. This should not be left to chance but must be checked and recorded at every appointment.

9. The four first appointments average about one-half hour each, but the subsequent visits are usually brief.

10. Since the suppression of the forward movement of maxillary teeth, despite good dental-facial growth, and the full encouragement of the forward movement of the mandible, in conjunction with this good dental-facial growth, are mutually essential to successful treatment, the prognosis is in direct proportion to the patient's growth.

The four salient points are: (1) differential diagnosis, (2) facial growth, (3) patient cooperation and (4) an efficient headcap.

I should like to thank the other members of the Bull Study Group, and particularly Dr. Harry Bull. Their comments and constructive criticisms during the past years have been invaluable.

70 Anderson St.

A FIFTH COLUMN WITHIN NORMAL DENTAL OCCLUSIONS

MURRAY L. BALLARD, D.D.S., SANTA ROSA, CALIF.

THE term *fifth column* in recent years has been applied to subversive influences having as their goal the destruction of peace, harmony, and the well-being of the state in which they operate.

There are many subversive elements which exert influences in varying degrees upon the normal growth and development of the human dentition and associated oral parts. One element which I have singled out to discuss particularly in this article is the relative size of the teeth as applied to the relationship of the six upper incisors with the six lower incisors as found in a large group of orthodontic patients.

I would like to discuss briefly a few of the contributions to orthodontic literature which either are related to the problem discussed in this article, or help form a background to aid one in realizing the significance and importance of this problem to the practice of orthodontics.

Orthodontics has been defined as "that science which has for its objective the prevention and correction of dental and oral anomalies."

Science has been defined as "knowledge gained and verified by exact observation and correct thinking especially as methodically formulated and arranged in a rational system."

I believe that all orthodontists will agree that normal occlusion of the teeth is undoubtedly one of the most important objectives of orthodontic treatment.

The term *normal occlusion* has been defined by Strang[1] as follows: "Normal occlusion of the teeth is the normal relationship of the so-called occlusal inclined planes of the teeth when the jaws are closed, accompanied by the correct proximal contacts and axial positioning of all teeth and the normal growth, development, location, and correlation of the various associated tissues and parts."

Angle approached the subject of occlusion from an idealistic standpoint. He felt that the sizes, forms, interdigitating surfaces and positions of the teeth in the arches are such as to give to one another, singly and collectively, the greatest possible support in all directions. He believed that Nature intended all parts of the human denture to be in harmony, not only with each other, but also with the rest of the associated parts of the face and mouth. In

This thesis, which was given as a partial fulfillment of the requirements for certification by the American Board of Orthodontics, is being published with the consent and the recommendation of the Board, but it should be understood that it does not necessarily represent or express the opinion of the Board.

the quest of perfection in orthodontic treatment, the orthodontist can find no nobler objective than that expressed by Dr. Angle[2] in his famous definition of the "line of occlusion."

From a practical standpoint, however, orthodontists and their fellow workers in research have found that Nature, unfortunately, has not created all parts of the human body in harmony. These disturbing unharmonious factors first must be recognized; second, they must be considered in their relation to treatment; and, finally, measures must be taken which will correct or reduce their interference with a treatment plan seeking an ideal result, bringing all parts of the denture and its associated parts into a harmonious relationship.

Attaining harmony is a question of proportion in the size, shape, relationship, and orientation of the dental organs as a whole in their relation to other facial factors. In searching for this objective, the orthodontist is faced with the limitless combinations which the component parts of the dental organs, face, and entire head are capable of producing. It may not be desirable, but often it has been absolutely necessary for the orthodontist to effect certain compromises in order to attain more idealistic and harmonious results. Unfortunately, we orthodontists cannot evade the fundamental law of Nature that all vital processes proceed to their objectives in a series of correlated steps, each of them dependent upon the other but none of them predictable.

Brodie[3] has stated: "Each individual is distinct so far as the morphological characteristics of the head are concerned. Just as there are no two sets of identical fingerprints, there are no two identical heads. Each component of the pattern, and even parts of the components, exhibits wide ranges of variation and these variants are combined in the individual in what appears to be a chance manner. One can establish a norm by taking an average of all of the variants and combining them, but having done so, the result is without significance for diagnosis. Other heads are not harmonious deviations from this norm."

Wylie[4] has stated: "Orthodontia requires sober reflection upon the limitations imposed upon even the best among us, and at the same time demands that we do the best we can within those limitations. As architects of the human face we should give up the vain search for what 'nature' intended and face the fact that nature has no intentions at all. Let us instead study more thoroughly and define more clearly what we intend to do with the facial pattern." He believes that this trend is already under way among clinical orthodontists, with the showing of treated results in greater number and with a reduction of emphasis on one or two hand-picked cases. Treatment planning, sometimes called diagnosis, will increase in effectiveness as orthodontists build treatment planning more around their concept of what they think treatment can accomplish and less around what they fancy was originally the cause of the malocclusion.

One factor that orthodontists must face is that teeth differ from bones. We are not born with our teeth in place, and they do not increase in size

with growth as age advances. Their initial patterns are laid down in full size. Teeth realize their full size in a matter of months and are not subject to modifying factors as in the case of bone.

The end result of a so-called chance combination of parts gives us the final form of the face. It has been shown that the relationship or proportion of these parts has been laid down by Nature at a relatively early date and, once laid down, they change very little through the developmental period. Nearly all parts within a given area have a tendency to remain stable and the relationship between the maxilla and mandible is determined at an early age and does not tend to change.

There have been a number of men who have published papers regarding the relative sizes of teeth, their relation to arch length, and their influence on occlusion and normal facial balance. I had the pleasure of doing some research work on tooth measurements a few years ago.[5]

I have mentioned previously how Dr. Angle and others had prevalently believed that the dental apparatus of man was potentially a perfect machine, harmonious in all its parts, needing only a skillful rearrangement by the orthodontist to render it functionally and esthetically perfect. This ideal was sound in its larger aspects, since it is the ultimate objective of every orthodontic case which is carried successfully to the end of active treatment. When analyzed in minute detail, however, it is manifestly deficient.

One might compare the inclined planes of the opposing dental arches with a system of gears in which harmony between the component parts is essential. When the articulating surfaces of the dental apparatus meet in this fashion, they achieve a dynamic balance where all parts are harmonious in size and form. The most gratifying realization of balance in the denture to the orthodontist is a treated case which remains unaltered for a long period after the removal of retaining appliances.

Since clinical experience has shown that such permanent stability is infrequent, one cannot help but wonder if there is not an unbalance among the component parts. If one could show that this unbalance prevails more often than has been realized in the past, then therapeutic measures should be initiated to establish the harmony which was not attained by natural means.

I made measurements of 500 sets of models. Fine-pointed dividers were used to determine the greatest mesiodistal diameters of each permanent tooth on the models. The dimensions, in millimeters, were taken from a finely calibrated millimeter rule and recorded in the data. The greatest mesiodistal diameter of each tooth was compared with that for the tooth of the opposite side and the discrepancies, if any, were catalogued. That such discrepancies between teeth of opposite sides of the same dental arch were almost universal is demonstrated by the fact that 448 out of 500 cases (90 per cent) measured showed left-right discrepancy in one or more pairs of teeth. I stated further that in any structure, natural or contrived, in which component parts interdigitate in such a definite manner as do the teeth and in which the articulating surfaces are so formed that settling into positions of stability is enhanced,

discrepancies of the magnitude of 0.5 mm. cannot be ignored. It has been shown that conditions prejudicial to perfect balance of the denture were found in nine patients out of ten. This means that if ideal contact point relationships are established in both arches and a highly satisfactory arch-to-arch relationship is achieved on one side, the other side may be thrown out by discrepancies in tooth size. Final stability can be attained only through alterations of inclined plane relationship from those considered ideal, or by adjustments in arch length through rotations and slipped contacts. It is not unlikely that these changes which frequently occur when treated cases are released from retention do so because of lack of harmony in tooth material from the outset.

We have considered so far only the relative size of the corresponding teeth in each arch as a separate unit. I would like to discuss the relationship of the upper six anterior teeth with the lower six anterior teeth. One of the most outstanding papers on this subject was written by Neff,[6] who stated that during basic treatment we spend a great deal of time and care in putting teeth into occlusion. This is especially true of the twelve anterior teeth, with which the patients and parents show the most concern. In some cases, proper alignment with the ideal amount of overbite is difficult to obtain. This could be due to a variation in proportionate tooth size of the upper and lower anterior teeth. Neff felt that a mathematical guide to find each normal occlusion's individual anterior overlap should be devised. The anterior coefficient was his answer to this problem, and was figured as follows: The mesiodistal widths of the six upper anterior teeth were measured by a pair of dividers with needle-sharp points. The measurements were punched out on a graph card in a straight line and the total length was measured in millimeters. The same was done for the six lower anterior teeth. The upper sum was divided by the lower sum and a figure, such as 1.22, was obtained. This is the anterior coefficient. In the measurement of over 200 cases, Dr. Neff found that a range of 24 points was tabulated. The lowest was 1.17 and the highest, 1.41. He felt that an anterior coefficient of 1.20 was ideal.

I have approached this problem from a different direction. It is the primary purpose of this article to list the results of a study of the relationship of the twelve anterior teeth in a large group of orthodontic cases. I felt that the information obtained not only would be interesting from a research standpoint, but also could produce results from which conclusions regarding certain aspects of the etiology, treatment planning, and prognosis of malocclusion could be drawn. This problem was also approached in much the same manner as that in which I handled the task of measuring the mesiodistal widths in the article mentioned previously.[5] The same method of measurements, that is, sharply pointed dividers and a finely calibrated millimeter rule, and the same mesiodistal measurements were used. I listed all measurements on a card (Fig. 1). The total mesiodistal widths of the six upper incisors were totaled. The same procedure was followed with the six lower incisors.

I felt that the manufacturers of artificial teeth must have devised a mathematical formula to determine the relationship between the relative mesiodistal widths of the six upper anterior teeth and the six lower anterior teeth. It was felt that, since artificial teeth are constant in size and are manufactured to certain specifications, their relative measurements would be more accurate than those of natural human teeth which we know vary in size and shape. I felt that such a mathematical formula could be used as a so-called "normal" or constant value with which human teeth could be compared in determining their normalcy or variations, if any. I wrote to the

MURRAY L. BALLARD, D.D.S.
ORTHODONTIST
Santa Rosa, California

Name Lourilliard, Lorilee Model No. 400

Mesiodistal Tooth Dimensions (Mms.)

	RIGHT			LEFT			TOTAL
UPPER	8.	7.	9.	9.	7.	8.	48.00
	3	2	1	1	2	3	
LOWER	7.	6.5	5.5	5.5	6.5	7.	38.00

Sum of 321|123 48.00 Sum of 321|123 38.00

48.00 X 3/4 = 36.00 Normal = 36.00

⊕ 2.00
⊖

Notes—

Fig. 1.—Card used in listing the total mesiodistal widths of the six upper and the six lower anterior teeth.

world's largest manufacturer of artificial teeth, seeking this information. The head of the research department replied as follows: "The combined mesiodistal widths of the lower six anterior teeth is 75 per cent of the combined widths of the upper six anterior teeth. This relationship gives an average overjut of 1.0 mm." This formula coincides almost identically with that determined by Dr. Neff in arriving at what he considered an ideal anterior coefficient, as mentioned previously.

The combined total of the mesiodistal widths of the six upper incisors was multiplied by 75 per cent. The figure obtained by this procedure would be considered as the so-called normal or ideal total of the mesiodistal widths of the lower six incisors. This figure was compared with the actual totals of the combined mesiodistal widths of the lower six incisor teeth. Any variance or difference in the totals was measured as a plus or minus. If the two totals

were similar, the variance, of course, would be zero. A plus value indicated that the actual combined total of the mesiodistal diameters of the lower six anterior teeth was larger than the ideal total as determined by the mathematical formula. A minus value, on the other hand, would indicate that the total actual combined mesiodistal widths of the six lower anterior teeth was smaller

NUMBER OF CASES AND AMOUNT OF VARIATION FROM NORMAL IN RELATIONSHIP OF TOTAL MESIODISTAL WIDTHS OF UPPER AND LOWER SIX ANTERIOR TEETH

AMOUNT	NUMBER	AMOUNT	NUMBER	AMOUNT	NUMBER
-0	6	+0.25	19	+4.00	15
-0.25	5	+0.50	10	+4.25	11
-0.50	5	+0.75	11	+4.50	7
-0.75	2	+1.00	30	+4.75	4
-1.00	5	+1.25	26	+5.00	3
-1.25	1	+1.50	28	+5.25	3
-1.50	2	+1.75	21	+5.50	4
-1.75	1	+2.00	26	+5.75	2
-2.00	2	+2.25	30	+6.00	0
-2.25	0	+2.50	19	+6.25	0
-2.50	0	+2.75	19	+6.50	1
-2.75	1	+3.00	23	+6.75	1
-3.00	0	+3.25	29	+7.00	1
-3.25	1	+3.50	14	+7.25	0
-3.50	1	+3.75	9	+7.50	1
-3.75	1				

Fig. 2.—Tabulation of calculations on 400 different orthodontic cases.

than the ideal total as determined by the mathematical formula. These calculations were made on 400 different orthodontic cases, and the results were tabulated as follows (Fig. 2):

31 cases (7.75 per cent) had a minus variation.
6 cases (1.50 per cent) were normal.
363 cases (90.7 per cent) had a plus variation.
323 cases (80.7 per cent) had a plus variation of 1 mm. or more.
212 cases (50.3 per cent) had a plus variation of 2 mm. or more.
126 cases (31.5 per cent) had a plus variation of 3 mm. or more.
53 cases (13.2 per cent) had a plus variation of 4 mm. or more.
15 cases (3.75 per cent) had a plus variation of 5 mm. or more.

It is interesting to note on the graph (Fig. 3) that only 133, or 33.25 per cent, showed a variation of less than a plus 1.55 mm. and, of this number, 102 cases, or 25.5 per cent, were between 0 and a plus 1.55 mm. variation. The largest single group—209 cases (52.25 per cent)—had a plus variation between 1.55 mm. and 3 mm. There were 105 cases (26.25 per cent) with a plus variation larger than 3 mm. Since such a large number of these cases showed a plus variation of an appreciable amount, I felt that the reliability of the mathematical formula should be put to a practical test. For this purpose, the models of twenty completed orthodontic cases were selected from the Division of Orthodontia, University of California College of Dentistry. These were cases which were considered to be ideally treated with very favorable results. I was particularly interested in determining that there was harmony

in tooth size, cuspal relationship, arch form, overbite, and overjet. It so happened that ten of the cases had four premolars extracted and ten had been treated with the full complement of teeth.

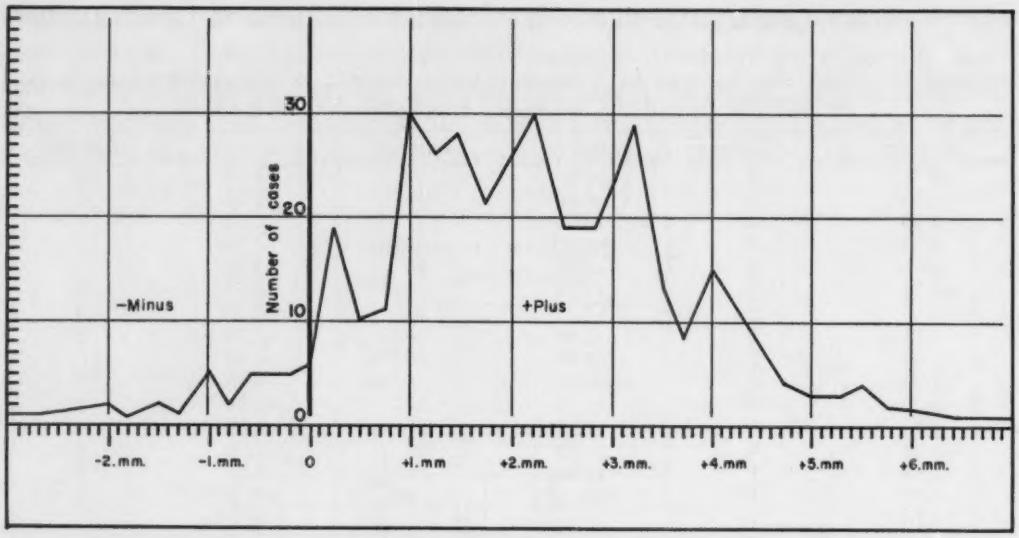


Fig. 3.—Graph showing the range of variation from normal in the relationship of the total mesiodistal widths of the six upper incisors with the six lower incisors in 400 orthodontic cases.

The mathematical formula showed an average plus variation of 1.20 mm., which is almost negligible. I feel that a slight variation from zero in either a plus or minus direction should be allowed in order to compensate for any possible human errors in the mechanics of compiling the measurements of the teeth under consideration. I do feel, however, that such a large percentage as 50.30, showing plus variations of 2 mm. or more, cannot be ignored. The significance of this figure means that, on an average, one out of every two orthodontic cases has an excess of tooth structure in the mesiodistal widths of the lower six anterior teeth in excess of 2 mm. It is only logical to assume that some measures must, of necessity, be initiated to correct this disharmony between the upper and lower units of the human denture.

The judicious stripping of proximal surfaces has been practiced by orthodontists in the past and should continue to be good practice. It should be remembered that in the mandibular anterior segment there are twelve proximal surfaces which may be stripped in order to obtain a more harmonious relationship with the upper anterior segment. If the variation in size approximates the mesiodistal width of a lower central incisor, the solution of the problem is simplified, of course, by the removal of a lower central incisor.

I feel, however, that the great problem is what to do with the large group of cases in which the variation is too large to be corrected by stripping the teeth and yet is not large enough to justify the extraction of a lower central incisor. This problem is very ably stated by Brodie:[7] "Returning to the

dental arch again, we note that a very slight disharmony will cause a lapping of contacts, particularly in the lower incisal region. Our occlusal relations may be perfect everywhere else, but we find one tooth with a persistent tendency to rotate or to drop out of line. We need but 2 mm. more space than has been supplied, but seem unable to maintain it. Now the question I would like to pose is this: Are we justified in extracting two premolars in this arch whose combined diameters measure 13 to 14 mm.[8] in order to gain 1 to 2 mm. of space? Are we to sacrifice all of the advantages of a normal interdigitation of the buccal teeth and the normal interproximal tissue conditions in order to align this one tooth? This seems like 'straining at the gnat and swallowing the elephant.' "

It appears to me that the "gears" referred to previously in this article are not uniformly good gears. They are not all harmonious in their relative sizes. It seems only logical to assume that if we wish to obtain a normal, harmonious dental mechanism, all the component parts would have to be normal in size, shape, and form. The sad truth is that in malocclusions we simply do not have these desired perfect parts with which to create an ideal dental mechanism. It is necessary for us to do the best we can with the faulty structural elements offered to us.

Since the final decision as to the type of treatment plan to be followed rests with the judgment of the individual orthodontist, experience is an invaluable asset. It would behoove young orthodontists to use extreme caution and take all factors affecting treatment into careful consideration before embarking upon a treatment plan.

Variations in tooth size and disharmony between the upper and lower anterior segments are only two elements in the large group of factors which must be taken into consideration in arriving at a correct etiology, diagnosis, and treatment plan for every single case of malocclusion to be treated orthodontically.

In conclusion, the following items are submitted for consideration:

1. The human denture is not the ideally perfect mechanism, as thought by the early practitioners of orthodontia.

2. There is an appreciable discrepancy in mesiodistal widths between the teeth of the left and the right sides.

3. Measurements on 400 orthodontic patients show that in more than 50 per cent the total mesiodistal width of the lower six incisors is 2 mm. or more in excess of their ideal relationship with the total mesiodistal width of the upper six anterior teeth.

4. This variation in tooth size and the relationship of upper and lower anterior segments are of sufficient incidence and magnitude to merit serious consideration in the etiology, diagnosis, and treatment planning in every orthodontic case.

I strongly suggest that all possible security measures be initiated by the orthodontist in the formulation of a treatment plan. This is vitally necessary in order to combat and, if possible, eliminate all the destructive influences

produced by that insidious fifth column working within the dental mechanism, namely, disharmony in the relative sizes of the teeth as applied to the relationship of the six upper incisors to the six lower incisors.

REFERENCES

1. Strang, Robert H. W.: Textbook of Orthodontia, ed. 3, Philadelphia, 1950, Lea & Febiger, chap. 1, p. 18.
2. Angle, Edward H.: Malocclusion of the Teeth, ed. 7, Philadelphia, 1907, S. S. White Dental Manufacturing Company, Chap. 1, p. 22.
3. Brodie, Allan G.: Appraisal of Present Concepts in Orthodontia, Angle Orthodontist **20**: 24-38, 1950.
4. Wylie, Wendell L.: Malocclusion-Malady or Malformation, Angle Orthodontist **19**: 9, 1949.
5. Ballard, Murray L.: Asymmetry in Tooth Size—A Factor in the Etiology, Diagnosis and Treatment of Malocclusion, Angle Orthodontist **14**: 67-70, 1944.
6. Neff, Cecil W.: Tailored Occlusion With the Anterior Coefficient, AM. J. ORTHODONTICS **35**: 309-333, 1949.
7. Brodie, Allen G.: Does Scientific Investigation Support the Extraction of Teeth in Orthodontic Therapy? AM. J. ORTHODONTICS AND ORAL SURG. **30**: 452, 1947.
8. Black, G. V.: Descriptive Anatomy of the Human Teeth, Philadelphia, 1902, S. S. White Dental Mfg. Co., pp. 16-17.

INFLUENCE OF HEREDITY IN THE ETIOLOGY OF MALOCCLUSION

KATHRYN F. STEIN, PH.D.,* THOMAS J. KELLEY, D.D.S., M.S.,** AND EUNICE WOOD, M.A., BOSTON, MASS.

MALOCCLUSION of the teeth and jaws has been said to be the most common structural defect in man.[1-3] Volumes have been written concerning its etiology, the larger proportion dealing with environmental factors such as sucking habits, pressures (both intrauterine and those due to sleeping positions), mouth breathing, loss and retention of teeth, endocrine imbalance, and nutritional deficiencies. A considerable section, however, has been devoted to attempts to discover the influences of hereditary factors and a large group of writers has emphasized the importance of consideration of such factors in the treatment of the various conditions involved.

REVIEW OF THE LITERATURE

As early as 1935 Keeler[4] stated, "We must stop quibbling about whether heredity affects the teeth," and produced a number of pedigrees of various conditions to show that it did. Sawin[5] reported on four cousins with a similar type of overbite, and Lebow and Sawin[6] published additional pedigrees indicating inheritance of human facial features. Moore and Hughes[7] summarized a large part of the literature up to that date and pointed out that there were little specific data but a growing conviction of the importance of the hereditary mechanism, expressed, for example, in the statement of Goldstein and Stanton[8] that heredity is undoubtedly the direct cause of malocclusion in specific instances. For the lower animals, this has been indicated by the work, among others, of Johnson[9] and Stockard[10] on dogs, and Grüneberg[11] on mice. Moore and Hughes[7] observed individuals of fifty-six families with ninety-five children and found that the incidence of asymmetry in absolute size of jaw parts in children with asymmetrical parents was 300 times as great as in children with normal parents. They conclude that, in the form of the arches, the crowding and spacing of teeth, the number of teeth, type of occlusion, and depth of "bite," children tended to follow the parental pattern. They believe that single genes may operate in causing rotated teeth, but suggest multiple factors for crowding and spacing. Hyde,[12] Moore,[13, 14] Hughes,[15] and Tager[16] emphasized the practical use of heredity in orthodontic practice.

This investigation was supported by research grants from the National Institute for Dental Research of the National Institutes of Health, Public Health Service, and from Sigma Xi.

*Professor of Zoology, Mount Holyoke College.

**Instructor, Department of Graduate Orthodontics, Tufts University School of Dental Medicine.

The role of race mixture in the etiology of malocclusion suggested by Davenport[17] has been debated extensively. While various investigators have considered that little or no evidence exists for inheritance of large or small teeth from one parent and small or large jaws from the other, with consequent malocclusion, Abel as early as 1931 (reported by Berger[18]) recorded the observation, in Negro-Hottentot and Negro-Bushman crosses, of small teeth of the Hottentot in a broad Negro jaw and crowding of large Negro teeth in a small Hottentot jaw. Rabkin,[19] in 1952, concluded that the trend for frequency of faciojaw deformities is especially evident in Europeans, where random mating between diverse, physically different types is common. Recently Moorrees and Reed[20] demonstrated statistically that variance of crowding or spacing of teeth was associated primarily with a lack of correlation between the size of the teeth and the size of the dental arch. In crosses of different breeds of dogs, Johnson (in Stockard[10]) claims that malocclusion in these animals definitely, and probably in man, is caused by differences in size or shape between the upper and lower jaws due to the different genetic backgrounds of the parents.

Data from multiple births have frequently been brought forward in support of the inheritance of facial characters but are usually concerned with a limited number of pedigrees. The evidence, on the whole, indicates that identical twins resemble each other more than fraternal twins. Detlefsen,[21] from a study of thirty-five pairs of identical twins, reported that tooth and arch shape and size are inherited. For the arch form, Goldberg[22] states that unilateral differences between twins are, in the main, less than bilateral differences between sides of the same twin, with a few exceptions. Bachrach and Young[23] noted that coincidence of the type of occlusion was greater in identical than in fraternal twins of the same sex. Macklin and Moore[24] expressed the opinion that, although diet and thumb-sucking might alter the shape of the jaw, the evidence from twins is strongly on the side of heredity. The Dionne quintuplets, as reported by Ford and Mason,[25] all had anomalous second permanent lower molars and narrow mandibular arches which resulted in malocclusion. Lundström,[26] in a study of 100 identical and 102 fraternal twins, found greater dissimilarity in the latter, both as regards malocclusion and in number and type of teeth lost.

There is a growing fund of evidence for Brodie's concept[27, 28] that the development of the dentition is based on a congenital pattern. Growth patterns are considered to be hereditary,[29, 30] and the factors involved are believed by an increasing number of investigators to act separately upon different parts of the head and face.[31-33] As Wylie[31] so aptly remarks concerning facial disproportions, "An increasing number of us are inclined to the belief that the chromosomes put the different pieces in the same box."

In spite of the apparent availability of material, very few statistical studies have been made on the problem of occlusion. That of Iwagaki[34] is almost alone in the field and deals with mandibular protrusion and edge-to-edge bite in Japanese dental students and their families. Rubbrecht[35] also reported on mandibular prognathism and concluded that the inheritance was irregularly dominant and that all types of occlusion are influenced to a great extent by heredity.

Wylie[36] used a quantitative approach to determine similarities between cephalometric measurements in related individuals, but his results were rather disappointing as a demonstration of the influence of heredity. If his results are averaged, however, they do show increasing degrees of similarity as one goes from unrelated persons to sibs and finally to identical twins.

Several investigators, including Hooten,[37] have suggested the value of cephalometric study for an analysis of the role of heredity. The work of Wylie[36] has already been mentioned. Curtner[38] superimposed head films of related persons to show similarities and concluded that it seemed possible to predetermine the adult face in most children by the superimposition of their head films upon those of their parents. Parent-child, brother-brother, and sister-sister correlations of head length, breadth, and cephalic index are reported by Ikeda[39] to be caused by hereditary factors. The present article is primarily an analysis of correlations among relatives for a group of angles measured on tracings from radioautographs. We wish to express our thanks to Dr. H. I. Margolis for the loan of a Margolis cephalostat and for his helpful interest and advice.

MATERIAL AND METHOD

For the cephalometric study, the first subjects chosen were Mount Holyoke College students with sisters in college. Other members of their families were examined, wherever possible, and also a group of families living within a twenty-five-mile radius of the college. Each subject was examined to determine type of occlusion, which was classified according to the Method of Angle, and to observe any deviations from the normal as regards missing, transposed, or malformed teeth. Black and white photographs of front, left, and right views of the teeth, with the subject holding cheek retractors, were taken with a Photek clinical unit. Notes were made on the degree of overbite and overjet, and the intercanine width was measured for both maxilla and mandible. A history was taken concerning the following: diseases, with age of contraction and degree of severity and with special questions concerning deficiency diseases and endocrine imbalance; nail biting and sucking habits, with degree and duration of habit; age of loss of temporary teeth and of eruption of permanent teeth. All data were recorded by filling in blanks on an individual record sheet which also included the subject's age, names and ages of sibs, and name and address of family dentist and/or orthodontist. The latter were consulted in several cases and gave helpful assistance. Two hundred seventy-five subjects were interviewed and the data were compiled.

Lateral cephalometric radiographs of all persons were made with a Ritter x-ray machine and with the patient fixed in a Margolis cephalostat. The distance from the film to the x-ray source was the standard five feet. Landmarks were located on the x-ray headplates, and outlines including these landmarks were traced on sheets of Traceolene. Various angles were then drawn and measured (Figs. 1 and 2). The following have been selected for this report:

1. The mandibular plane angle, the angle between the mandibular plane (line tangent to the lower border of the mandible) and the Frankfort

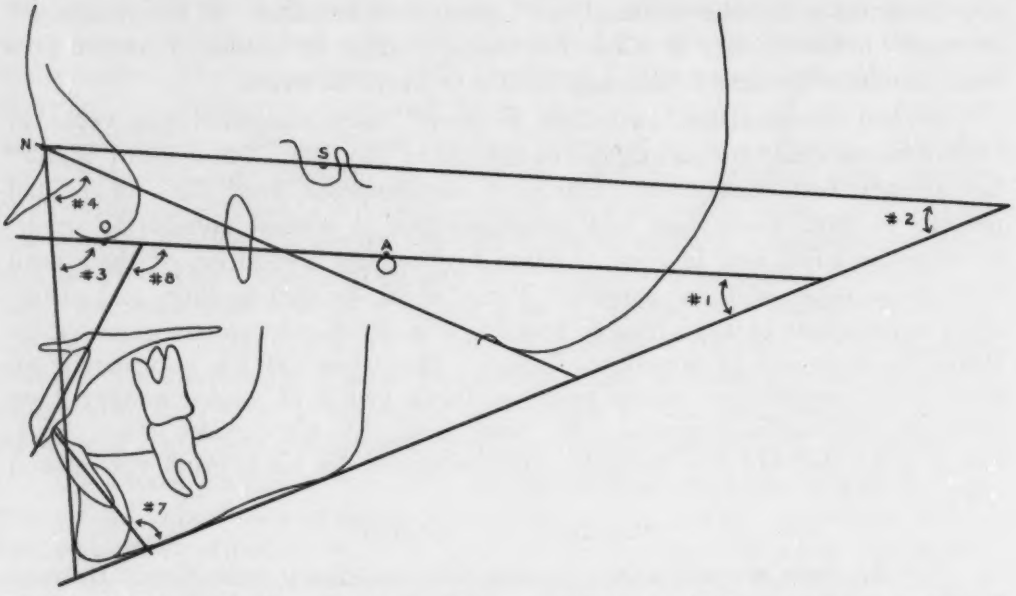


Fig. 1.—Diagram of angles *1* to *4*, *7* and *8*. *A*, Point on auditory meatus; *N*, nasion; *S*, center of sella turcica.

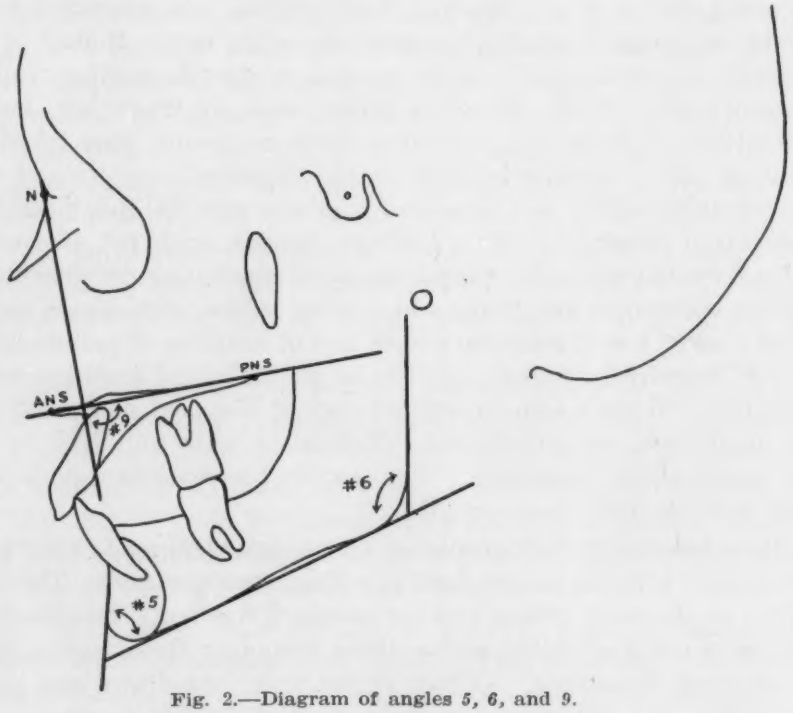


Fig. 2.—Diagram of angles *5*, *6*, and *9*.

plane (line connecting the lowest point of the left bony orbit with the uppermost boundary of the external auditory meatus).

2. Mandibular plane angle No. 2, the angle between the mandibular plane and a line drawn through nasion (point of junction of frontal and nasal bones) and sella (center of sella turcica).
3. Facial angle, the angle between the facial plane (line connecting nasion and the most anterior point on the mandible) and the Frankfort plane.
4. Facial angle No. 2, angle between the facial plane and the Bolton plane (line connecting nasion and the Bolton point which is at the junction of the outer plates of the occipital bone with the posterior margin of the occipital condyle).
5. Anterior mandibular angle, the angle between the anterior surface and the base of the mandible.
6. Posterior mandibular angle, the angle between the posterior surface and the base of the mandible.
7. Lower incisor—mandibular plane angle.
8. Upper incisor—Frankfort plane angle.
9. Palatine-anterior facial angle, the lower angle between the palatine plane (anterior nasal spine to posterior nasal spine) and a line from nasion through point A (innermost point on curvature from the maxillary anterior nasal spine to crest of maxillary process).

Individual tracings of members of the same family, including those of four sets of twins, were compared, and composite tracings were made of certain cases.

Data concerning type of malocclusion and environmental history, in addition to that gathered by individual examination by the authors, were obtained in some cases by students from their families after careful instruction. In all, 150 pairs of parents with 364 sibs are included in these data. Identification of the type of occlusion was aided by the use of "bite papers" which consisted of two pieces of graph paper sandwiched between two pieces of carbon paper. The four pieces of paper were stapled together and the subject inserted the "sandwich" into his mouth and bit, thus making the impression. All questionable impressions were discarded.

A small number of these same families were later re-examined, photographed, and used for the cephalometric study, which includes data from 275 persons.

OBSERVATIONS AND RESULTS

Correlation of Angles.—Sibling pairs (sister-sister and brother-sister) were more consistent than any other related pairs in showing a positive correlation. Differences from zero correlation are significant at the .01 level for most, and at the .05 level for all the angles investigated (Table I) except the posterior mandibular angle (No. 6) and the two incisor angles (Nos. 7 and 8). For the

TABLE I. CORRELATION VALUES FOR FACIAL ANGLES

ANGLES	COMPARISONS	NO. OF PAIRS	CORRELATION COEFFICIENT (R)	FISHER'S Z	STANDARD ERROR σ	$\frac{Z}{\sigma}$	SIGNIFICANT AT LEVEL .05	.01
1. Mandibular plane angle	Sister-sister	51	0.478	0.520	±0.144	3.61	+	+
	Sister-nonsister	101	–0.037	–0.037	±0.101	0.37	–	–
	Mother-daughter	53	0.29	0.30	±0.14	2.1	–	–
	Brother-sister	44	0.32	0.33	±0.16	2.06	+	–
	Father-daughter	47	0.30	0.31	±0.15	2.07	+	–
	Mother-son	31	0.529	0.589	±0.189	3.12	+	+
2. Mandibular plane angle No. 2	Sister-sister	50	0.475	0.517	±0.146	3.54	+	+
	Sister-nonsister	93	–0.129	–0.130	±0.105	1.24	–	–
	Mother-daughter	50	0.23	0.23	±0.15	1.5	–	–
	Brother-sister	42	0.47	0.51	±0.16	3.19	+	+
	Father-daughter	47	0.50	0.55	±0.15	3.67	+	+
	Mother-son	31	0.32	0.33	±0.189	1.75	–	–
3. Facial angle	Sister-sister	50	0.538	0.60	±0.146	4.1	+	+
	Sister-nonsister	100	0.033	0.033	±0.106	0.31	–	–
	Mother-daughter	51	0.16	0.16	±0.14	1.1	–	–
	Father-daughter	48	0.52	0.12	±0.19	0.71	–	–
	Mother-son	31	–0.142	–0.14	±0.189	0.74	–	–
	Father-son	24	0.53	0.58	±0.22	2.64	+	+
4. Facial angle No. 2	Sister-sister	52	0.342	0.356	±0.143	2.49	+	+
	Sister-nonsister	97	0.058	0.058	±0.103	0.56	–	–
	Mother-daughter	51	–0.006	–0.01	±0.14	0.1	–	–
	Mother-son	31	0.282	0.29	±0.189	1.53	–	–
5. Anterior mandibular angle	Sister-sister	57	0.29	0.30	±0.136	2.21	+	–
	Sister-nonsister	112	–0.164	–0.17	±0.96	0.18	–	–
	Father-daughter	48	0.22	0.23	±0.15	1.53	–	–
	Brother-sister	36	0.42	0.45	±0.16	2.81	+	+
	Mother-son	31	0.101	0.101	±0.189	0.534	–	–
6. Posterior mandibular angle	Sister-sister	59	0.24	0.25	±0.13	1.9	–	–
	Sister-nonsister	112	0.023	0.023	±0.1	0.23	–	–
	Father-daughter	48	0.13	0.13	±0.17	0.08	–	–
	Mother-son	31	0.221	0.225	±0.189	1.19	–	–
7. Lower incisor—mandibular angle	Sister-sister	41	0.06	0.06	±0.146	0.41	–	–
	Sister-nonsister	80	0.18	0.18	±0.109	1.65	–	–
	Mother-daughter	42	–0.01	–0.01	±0.15	0.67	–	–
	Brother-sister	28	0.27	0.28	±0.20	1.4	–	–
	Mother-son	21	–0.103	–0.104	±0.224	0.46	–	–
8. Upper incisor—Frankfort plane angle	Sister-sister	50	0.25	0.25	±0.162	1.54	–	–
	Sister-nonsister	87	–0.27	–0.28	±0.114	2.46	–	–
	Mother-daughter	46	0.27	0.27	±0.16	1.70	–	–
	Brother-sister	27	0.21	0.21	±0.20	1.03	–	–
	Mother-son	23	0.391	0.41	±0.224	1.83	–	–
	Father-son	18	0.39	0.41	±0.26	1.58	–	–
	Father-daughter	37	0.02	0.02	±0.17	0.12	–	–
9. Palatine anterior facial angle	Sister-sister	40	0.634	0.75	±0.16	4.6	+	+
	Sister-nonsister	75	0.10	0.10	±0.12	0.83	–	–
	Mother-daughter	42	0.03	0.03	±0.16	0.20	–	–
	Father-daughter	33	0.565	0.64	±0.18	3.60	+	+
	Brother-sister	23	0.75	0.97	±0.22	4.40	+	+
	Mother-son	21	0.461	0.50	±0.236	2.12	–	–

latter angles, no significant degree of correlation was found in any of the relationships studied. It is interesting to note that no correlations significantly different from zero were observed between mothers and daughters. Between mothers and sons, on the other hand, there was significant positive correlation for the mandibular plane angle No. 1 (at both the .01 and .05 levels) and the coefficient for the palatine facial angle (No. 9) was close to significance (at the .05 level). For the former, the correlation coefficient was the highest observed (0.589) in any relationship, and closely approximated that between sisters. Also for this angle, mother-daughter correlation, although not significantly different from zero, is higher than for any other angle measured. The same two angles provide data indicative of positive father-daughter correlation, as does also the mandibular plane angle (No. 2) for which the coefficient of correlation is similar to those observed between sibs for this angle. Unfortunately, the data for father-son and brother-brother pairs are too few for analysis at this time, with one exception. For the facial angle (No. 3), there is evidence of significant positive correlation between fathers and sons.

The greatest degree of correlation for any of the angles measured is evident in the data for the palatine anterior facial angle (No. 9). This angle was chosen for measurement because it was considered to indicate relation of the maxilla to the upper face and because its determining lines are fairly well localized in the upper face. Variation in the lower jaw or in the roof of the cranium, for instance, would not tend to cause variation in this angle. Size differences occurring during development of the maxillary or median nasal processes, however, would be reflected in this measurement. If there were maxillary prognathism relative to the upper face, this angle would differ from normal. If malocclusion were due to a reduction or increase in the size of the mandible, on the other hand, the angle might be of a size harmonious with the upper face.

Comparison of Radiographs and Tracings.—

Twins: Only four pairs of twins (three identical and one fraternal) were included among the subjects of this study. The identical pairs were all females and the fraternal pair was male. Correspondence in shape of skeletal head structures is indicated in the headplates and in the superimposed tracings made from them (Figs. 3 and 4). It is obvious that the identical partners of each pair are extremely similar while the fraternal pair show greater intrapair differences. The sizes of the angles are also very close for two of the identical pairs, but differ more widely for the third and most widely for the fraternal pair.

Other relationships: Close resemblance was also observed within families, for instance, in the shape of the mandible (Fig. 5), and examples of this were found for all types of relationships observed. The measurements of angles bear out, in the main, the evidence from the superimposition of tracings.

Frequency of Malocclusion and Family Pedigrees.—In the preliminary investigation of this problem, data were collected from individual students, who,

in some instances at least, collected data from their immediate families. For this sample the incidence of malocclusion of all types was found to be 46.3 per cent in a sample of 150 families. This is low compared with estimates from

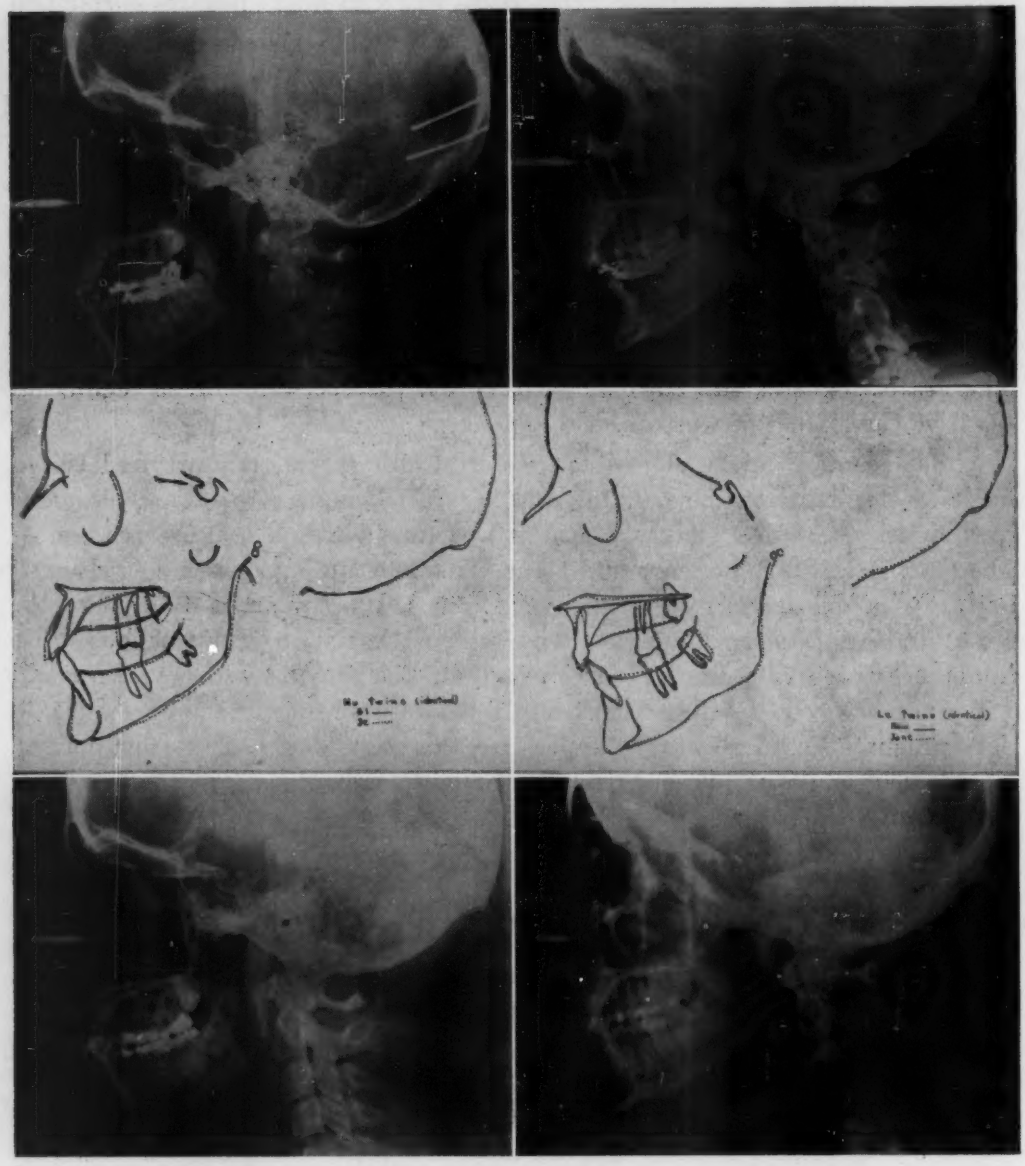


Fig. 3.—X-ray headplates and superimposed tracings of two pairs of identical twins.

the literature[1] (for instance, 59 per cent reported by Mebane for 3,000 school children in Minnesota, and 68 per cent reported by Shaw for a sample of the English population). It is probable that some cases of malocclusion were overlooked in the present study. Among the 150 students individually examined by one of us (E. W.), the percentage of malocclusion of all types was higher, close to 80 per cent. This high proportion may be accounted for, in part at

least, by the method of selection of the index cases. Members of zoology classes were invited to participate and to enlist their friends and, since they were aware that the project was concerned with the influence of heredity on malocclusion, it is possible that volunteers included a larger proportion of "victims" than are present in the general population. On the other hand, Moore

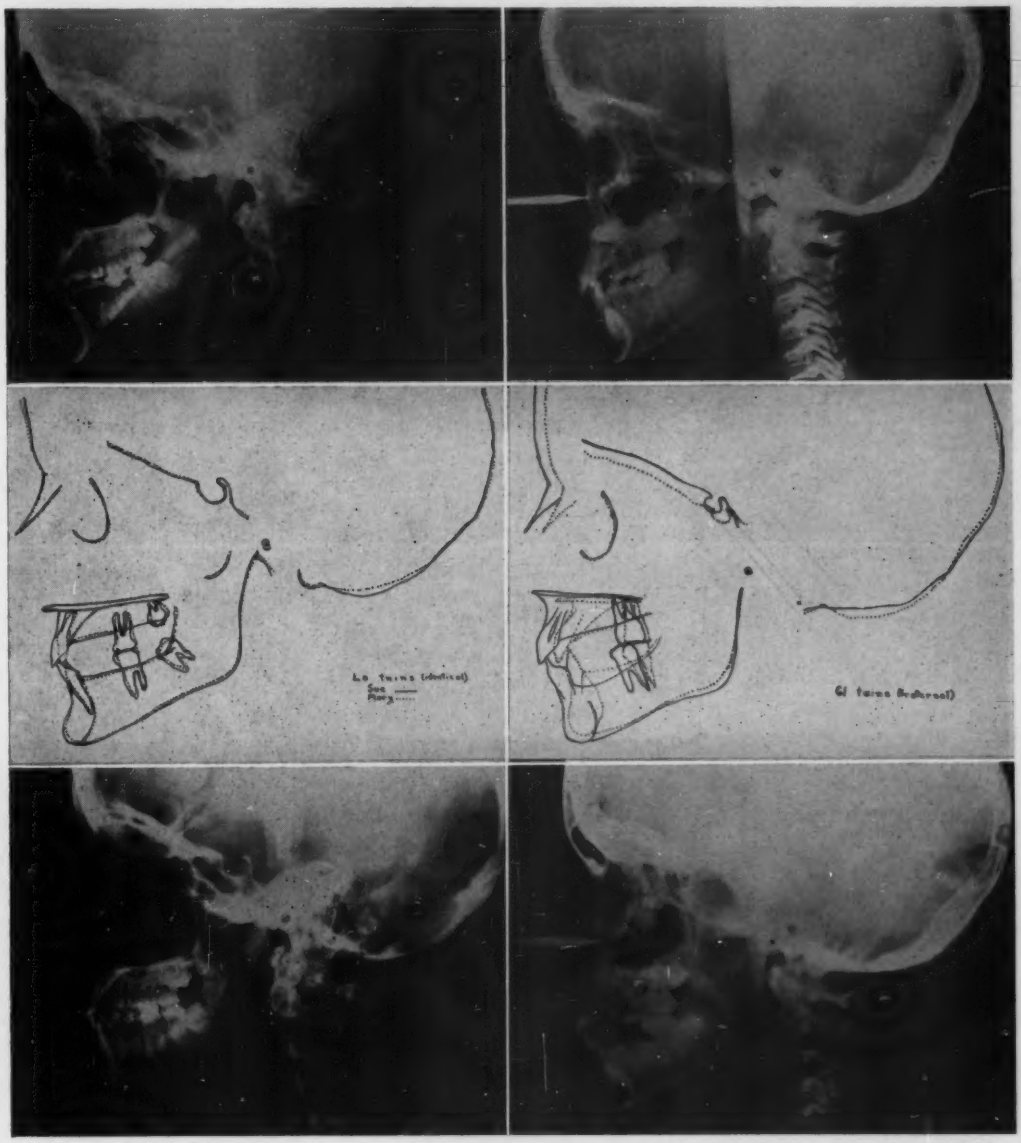


Fig. 4.—X-ray headplates and superimposed tracings of two pairs of twins, *Lo* (left) identical and *Gl* (right) fraternal.

and Hughes[7] reported an incidence of 88.2 per cent for all types of malocclusion in ninety-five families where the index cases were children who came to the orthodontic clinic because of concern over a real or apparent dentofacial disorder.

Data obtained from members of the families of the 150 index cases have been analyzed to discover the proportions of students with affected and unaffected relatives. It was found that only 33 per cent of the normal group had parents and/or sibs with malocclusion, compared to 77 per cent of the affected group (Fig. 6). Subdivision according to the type of relationship indicated that 13.6 per cent of the sibs and 22.7 per cent of the parents of normal

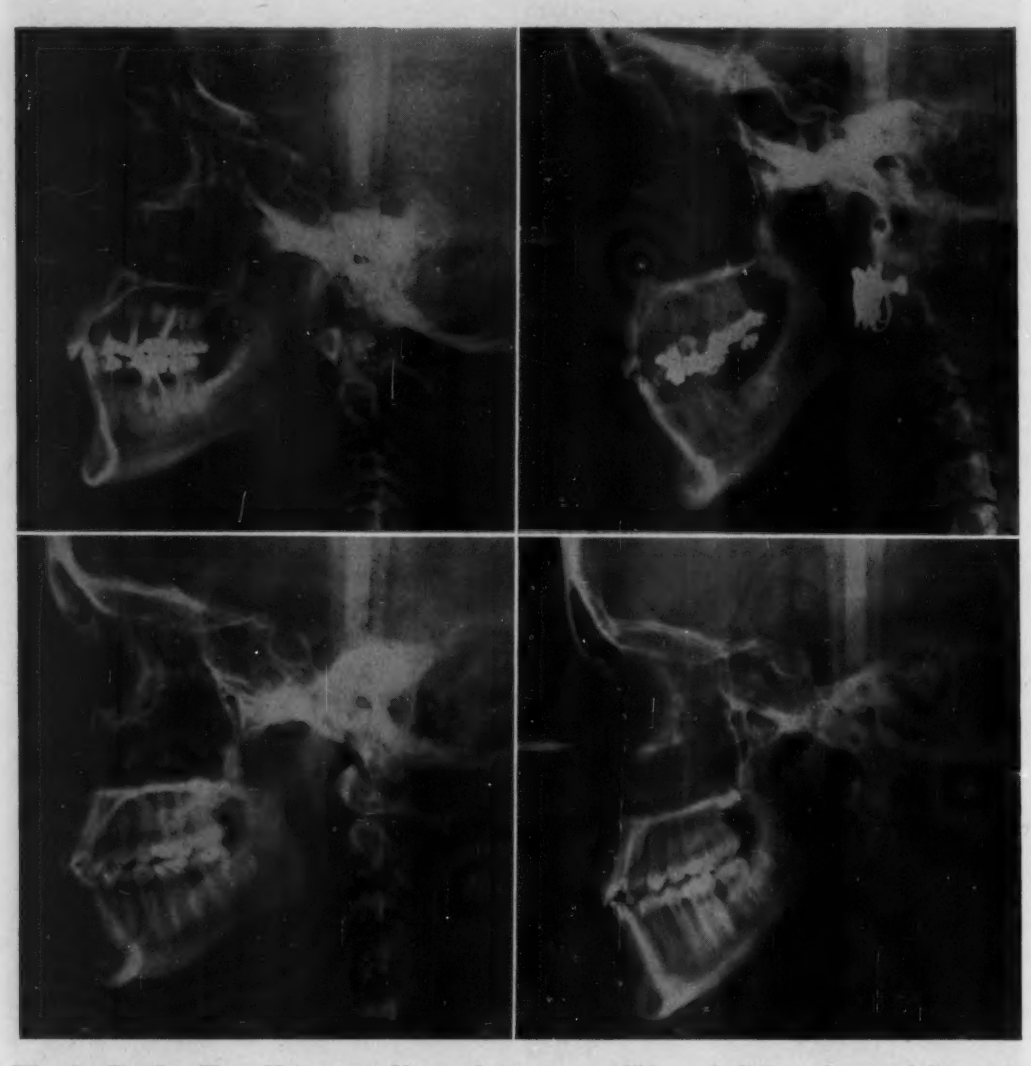


Fig. 5.—Family Ho. Note resemblance between mandibles of father (upper left) and daughter A (lower left), and between mother (upper right) and daughter K (lower right).

students had malocclusion, while 50 per cent of the sibs and 50.8 per cent of the parents of students with malocclusion were affected (Fig. 7).

Family pedigrees (Fig. 8) furnish numerous examples of malocclusion of the same type within families, whether molar occlusion in Angle's Class I or Class II. No attempt has been made to determine the type of Mendelian inheritance or the number of genes which may be involved in malocclusions in

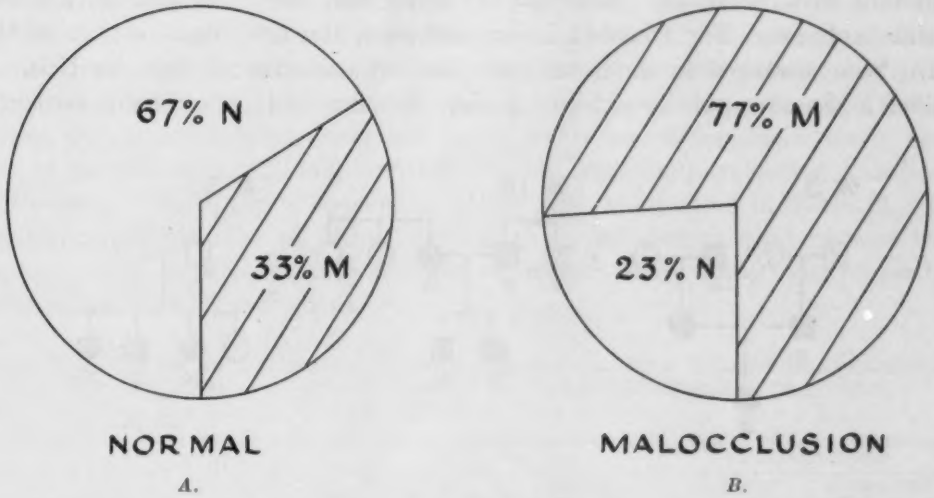


Fig. 6.—*A*, Percentage of students with normal bites having relatives (parents and/or sibs) with normal (*N*) and abnormal (*M*) occlusion. (Twelve per cent of those with normal relatives had no sibs.) *B*, Percentage of students with malocclusion having relatives (parents and/or sibs) with normal (*N*) and abnormal (*M*) occlusion. (Forty per cent of those with normal relatives had no sibs.)

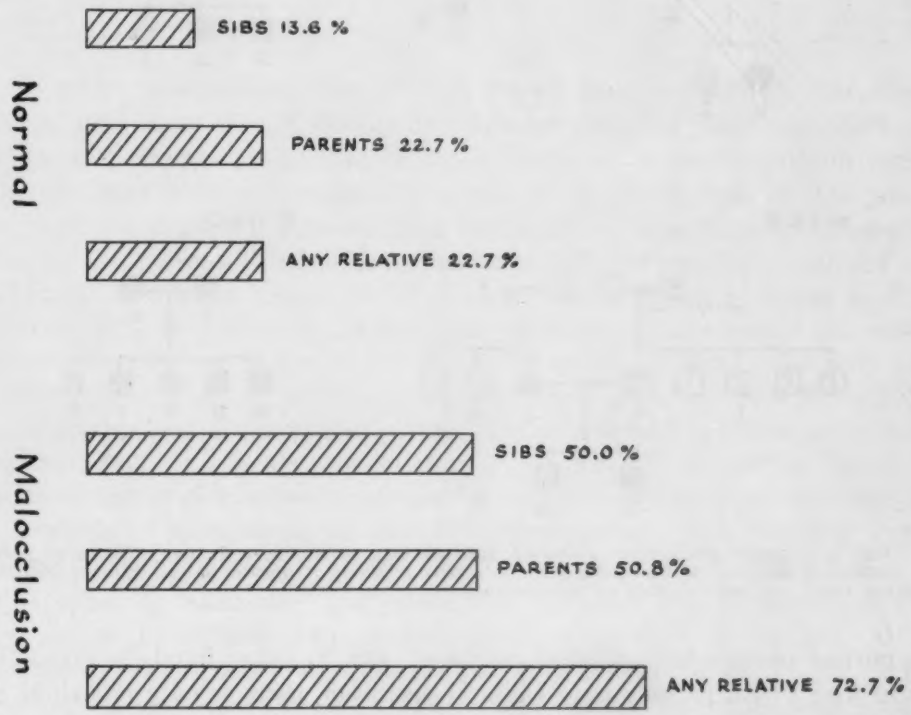


Fig. 7.—Percentages of relatives with malocclusion of students with normal or malocclusion.

persons with Class I molar occlusion. Class II malocclusion is usually concomitant with "overbite," although the latter may occur together with normal molar occlusion. For Class II molar occlusion, the total data, as far as they have been analyzed to date, indicate that transmission of this condition involves a recessive pair or pairs of genes. In some of the families investigated,

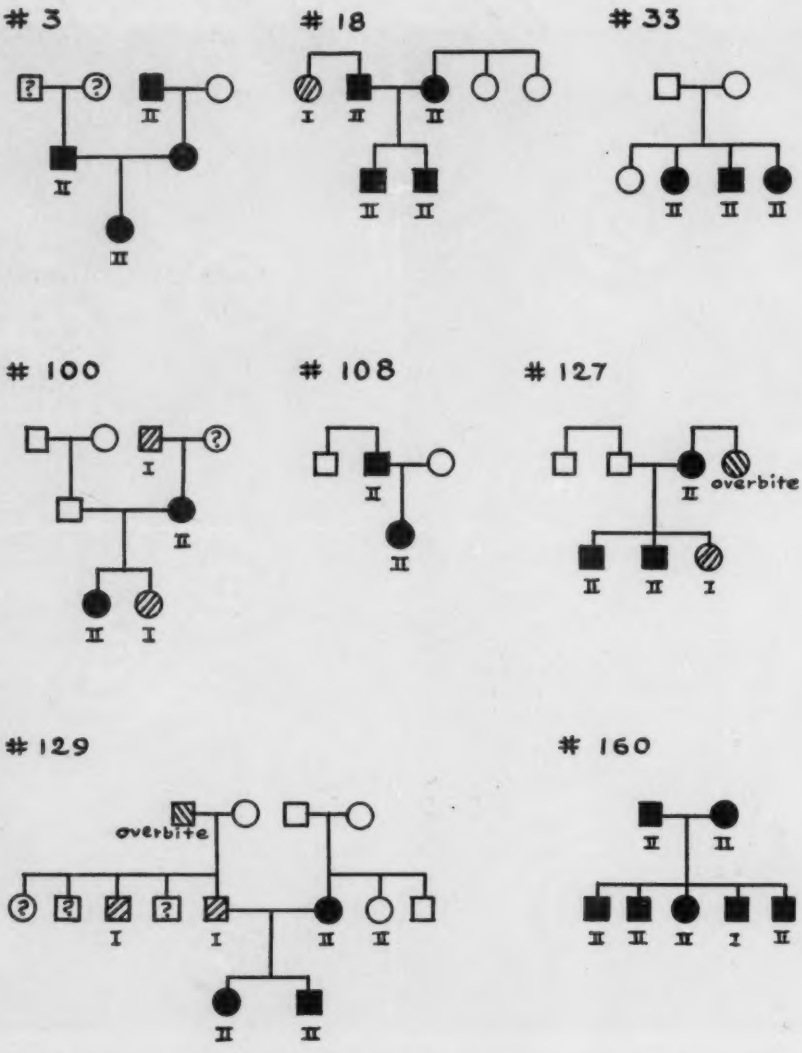


Fig. 8.—Family pedigrees. *I* and *II* indicate type of molar occlusion of affected persons. All unaffected persons in the pedigree have Type I molar occlusion unless symbol includes a question mark, indicating lack of information.

two normal parents have affected children. On the other hand, in seven families in which both parents have Class II occlusion, there is only one child (out of twenty) for whom normal occlusion was reported. It is possible that a mistake was made in diagnosis of this one exceptional case. Further work is planned on this phase of the problem.

Environmental Factors.—In view of the fact that so much work has been done on the role of various environmental agents in the manifestation of malocclusion, the data from the 150 students examined by E. W. were studied with the hope of ascertaining the effect of environment on this abnormality. The supposed "causes" of malocclusion include thumb-sucking and other sucking habits, premature loss of deciduous teeth, retention of deciduous teeth, early loss of permanent teeth, malnutrition, mouth breathing, endocrine imbalance, and others. This study is concerned mainly with those cited in Table II. The environmental histories of 140 of the 150 personally interviewed persons were studied. Ten were eliminated because of obvious uncertainty with regard to these environmental influences.

TABLE II. DATA ON ENVIRONMENTAL FACTORS ARRANGED TO SHOW NUMBER AND PERCENTAGES OF PERSONS WITH AND WITHOUT HISTORY OF THESE INFLUENCES IN THE NORMAL AND AFFECTED GROUPS

	NORMAL				MALOCCLUSION			
	PRESENT		ABSENT		PRESENT		ABSENT	
ENVIRONMENTAL FACTOR	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
Thumb- or finger-sucking	11	50.0	11	50.0	32	27.1	86	72.9
Early loss of deciduous teeth	3	13.6	19	86.3	7	5.9	111	94.1
Retention of deciduous teeth	3	13.6	19	86.3	8	6.7	110	93.2
Early loss of permanent teeth	0	0.0	22	100.0	6	5.1	112	94.9
Mouth-breathing	2	9.1	20	90.9	18	15.3	100	84.7
Calcium deficiency	2	9.1	20	90.9	10	8.5	108	91.5
Vitamin D deficiency	1	4.5	21	95.5	2	1.6	116	98.3
Summary	19	86.4	3	13.6	65	55.1	53	44.9

It seems rather clear, from the results of these tabulations, that thumb-sucking, premature loss of deciduous teeth, retention of deciduous teeth, and calcium and vitamin D deficiencies appear to be no more frequent in persons with malocclusion than in normal persons. It would be well, at this time, to remark on the degree of intensity and the length of time these conditions prevailed in the persons listed. In regard to thumb-sucking, many authors have stated that it is quite normal for a child to suck a thumb or finger until the age of 3 years[2] so that students who were reported to have ceased the sucking habit at about the age of 3 were not counted as thumb-suckers. With only a few exceptions, the cases of thumb-sucking that were reported were of relatively short duration and slight intensity; the time of cessation averaged around 5 or 6 years of age. It appears contradictory to the work of Lewis[40] on the subject of sucking habits and malocclusion that the two most severe cases reported (time of cessation, 13 years of age in each case) were persons with perfectly normal bite and straight, well-aligned teeth.

It is felt by Salzmann[2] and others that the early loss of permanent teeth often affects the occlusion and position of the other teeth in the jaw. Of the 140 students concerned here, only six had any history of early loss, and all these had malocclusion. Three of these persons had one or more molars pulled at the age of 12 or 13 years, and one had four molars extracted at the age of 9 years. The remaining two had upper incisors extracted at the ages of 14 and 15 years.

Of the twenty persons with mouth breathing habits, not one had a severe case showing signs of facial growth disturbance. For the most part, these mouth breathers were persons who had had the habit not longer than two to five years (average, about three years) when their adenoids were diseased or when they were troubled with severe sinus infections. Of these twenty, two persons have normal bite and, of the other eighteen with malocclusion, fourteen have relatives who also have malocclusion.

DISCUSSION

The total of the material included in this study seems to us to support the contention that heredity does play an important role in the determination of malocclusion. The data from family pedigrees are in line with reports in the literature, but with additional material on Class II molar occlusion which, to date at least, indicates the recessive nature of this condition. Whether one or more pairs of genes are involved has not been determined as yet.

Although it is impossible to draw conclusions from only four pairs of twins, the resemblance between the members of the three identical pairs is very striking for all parts of the face and cranium. This is in contrast to less closely related persons. While other investigators have reported greater intrapair differences in identical twins, they found, nevertheless, that such differences were less than in fraternal twins or sibs. That such differences may be due, in part at least, to asymmetry of the individual face is indicated by the works of Goldberg[22] and of Moore and Hughes.[7] Wylie[36] reported on a pair of twins, apparently identical, in which the craniofacial pattern of one member resembled that of the mother more than that of the co-twin. If his data for each relationship are averaged, however, they show the greatest degree of similarity between identical twins.

Coefficients of correlation obtained on the cephalometric measurements on the whole show least correlation between sister-nonsister pairs. Nonsisters were chosen at random from the total group of siblings, but were of approximately the same age as their partners. For four of the angles the coefficients are negative, and none of them differ significantly from zero condition. The only other negative correlations are between mothers and children. It is a disconcerting fact that for the mother-daughter relationship none of the angles investigated shows any significant correlation. It does not seem likely that this could be due to errors in technique, especially since the correlation for the mandibular plane angle is more highly significant between mothers and sons than for any other relationship. This fact and the several examples of significant positive correlation between fathers and children indicate that age cannot be the explanation. Perhaps these variations may be reflections of sex-linked factors in inheritance influencing particular sectors of the skull.

It is not certain, of course, that correlation coefficients between related persons, even when they are significantly different from zero, represent hereditary resemblance.[41, 42] Likenesses due to environmental causes would be similarly reflected. Some credence for a role of inheritance perhaps may be claimed, since environmental factors should produce as much resemblance between moth-

ers and daughters as in other parent-child relationships. It is also true that the posterior mandibular angle and the angles of the upper and lower incisors relative to their respective jaws show no correlation for any of the relationships studied. These angles, especially those of the incisors, probably are more easily influenced by environmental causes. Why should environmental factors be considered more alike within a family group for all except these particular angles?

The high degree of correlation of the palatine-anterior facial angle also seems more understandable if hereditary factors are involved. If, as is indicated from the literature, different genes affect different "pieces" of the skull, then angles involving relationship of localized sectors might be expected to show hereditary resemblances more consistently than those involving larger and more widely separated sectors. Presumably fewer genes might be involved in the former case than in the latter. Relative to the high degree of correlation obtained for the palatine-facial angle, it is interesting to note the experience of Stockard[10] and associates in their extensive crosses between breeds of dogs. From their results, they conclude: "The palatal index as a direct expression of the form of the upper jaw is more intimately correlated with the nature of dental occlusion than is the index for any other skull feature." They also found that genes governing size and shape of the maxilla acted independently of those affecting the mandible. It has been found in this investigation, by superimposition of headplates, that there are resemblances between related persons, sometimes for a single "sector," such as the mandible, and sometimes for the entire skull, as seen in the three pairs of identical twins.

No one of the particular environmental factors considered, with the possible exception of early loss of permanent teeth, seems to be causally concerned in the etiology of malocclusion. For the most part, sucking habits, mouth breathing, etc., were as prevalent among persons with normal bite as among those with malocclusion. However, it seems likely that environmental factors may aggravate malocclusion where factors for it are present. We concur with the statements of Hughes,[15] among others, that heredity and nurture, genetic constitution and environment cooperate in the determination of form and structure.

SUMMARY

1. Statistical correlation studies of facial angles measured from lateral radiographs taken with the use of a Margolis cephalostat indicate significant positive correlation in several instances, particularly between sisters. The angle formed by the palatine plane relative to the upper part of the face shows the highest degree of correlation.

2. Superimposition of tracings from radiographs shows likenesses between related persons, especially striking in three pairs of identical twins.

3. Family pedigrees indicate that similar types of occlusion occur in families and that Angle's Class II occlusion may be due to recessive factors.

4. Students with malocclusion had a higher percentage of relatives (sibs and/or parents) with malocclusion than those with normal bite.

5. No conclusive evidence was found for the influence of any particular environmental factor, such as sucking habits, for the causation of malocclusion.

REFERENCES

1. Brash, J. C.: The Etiology of Irregularity and Malocclusion of the Teeth, London, 1929, Dental Board of the United Kingdom.
2. Salzmann, J. A.: Principles of Orthodontics, Philadelphia, 1943, J. B. Lippincott Company.
3. Strang, R. H. W.: Textbook of Orthodontia, Philadelphia, 1943, Lea & Febiger.
4. Keeler, C. E.: Heredity in Dentistry, Dental Cosmos 77: 1147-63, 1935.
5. Sawin, P.: Applications of the Principles of Heredity to Orthodontics, AM. J. ORTHODONTICS AND ORAL SURG. 25: 401-418, 1939.
6. Lebow, M. R., and Sawin, P.: Inheritance of Human Facial Features, J. Hered. 32: 127-37, 1941.
7. Moore, G. R., and Hughes, B. O.: Familial Factors in Dentofacial Disturbance, AM. J. ORTHODONTICS AND ORAL SURG. 28: 603-639, 1942.
8. Goldstein, M. S., and Stanton, F. L.: Various Types of Occlusion and Amounts of Overbite in Normal and Abnormal Occlusion Between 2 and 12 Years, INT. J. ORTHODONTIA 22: 549, 1936.
9. Johnson, A. L.: The Constitutional Factor in Skull Form and Dental Occlusion, AM. J. ORTHODONTICS AND ORAL SURG. 26: 627-663, 1940.
10. Stockard, C. R.: The Genetic and Endocrine Basis for Differences in Form and Behavior, Philadelphia, 1941, Wistar Institute of Anatomy and Biology.
11. Grüneberg, H.: The Genetics of the Mouse, London, 1943, Cambridge University Press.
12. Hyde, W.: Heredity in Relation to Size of Teeth, J. Am. Dent. A. 25: 1762-1767, 1938.
13. Moore, G. R.: Heredity as a Guide in Dentofacial Orthopedics, AM. J. ORTHODONTICS 30: 549-554, 1944.
14. Moore, G. R.: The Orthodontic Program of the Michigan State Department of Health, With a New Classification of Occlusion for Survey Purposes, AM. J. ORTHODONTICS 34: 355-361, 1948.
15. Hughes, B. O.: The Growth of Children—Psychological and Hereditary Factors, AM. J. ORTHODONTICS 35: 16-24, 1949.
16. Tager, B. N.: Endocrine Problems in Orthodontics, AM. J. ORTHODONTICS 37: 867, 1951.
17. Davenport, H.: The Effect of Race Intermingling, Proc. Am. Phil. Soc. 56: 364-368, 1917.
18. Berger, H.: Constitution, Heredity and Orthodontia, AM. J. ORTHODONTICS AND ORAL SURG. 24: 136-150, 1938.
19. Rabkin, S.: Variations in Structural Morphogenesis of the Human Face and Jaws, J. D. Res. 31: 535-47, 1952.
20. Moorrees, C. F. A., and Reed, R. B.: Biometrics of Crowding and Spacing of the Teeth in the Mandible, Am. J. Phys. Anthropol. 12: 1, 1954.
21. Detlefsen, J. A.: Intrinsic or Hereditary Factors Versus Extrinsic or Environmental Factors in the Determination of Tooth and Oral Peculiarities, J. D. Res. 8: 419-20, 1928.
22. Goldberg, S.: Biometrics of Identical Twins From the Dental Viewpoint, J. D. Res. 9: 363-409, 1929.
23. Bachrach, H., and Young, M.: A Comparison of the Degree of Resemblance in Dental Characters Shown in Pairs of Twins of Identical and Fraternal Types, Dental Cosmos 70: 465-466, 1928.
24. Macklin, M. T., and Moore, S. A.: An Example of a Similar Type of Malocclusion in Identical Twins, J. Hered. 26: 445-450, 1935.
25. Ford, Norma, and Mason, Arnold: Heredity as an Etiological Factor in Malocclusion, J. Hered. 34: 57-64, 1943.
26. Lundström, A.: Tooth Size and Occlusion in Twins, AM. J. ORTHODONTICS 35: 878-9, 1949.
27. Brodie, A. G.: Some Recent Observations on Growth of Face and Their Implications to Orthodontists, AM. J. ORTHODONTICS 26: 741, 1940.
28. Brodie, A. G.: On the Growth Pattern of the Human Head Form From the Third Month to the Eighth Year of Life, Am. J. Anat. 68: 209, 1941.
29. Hughes, B. O.: Heredity and Variation in the Dentofacial Complex, AM. J. ORTHODONTICS 30: 543-548, 1944.
30. Fairbank, L. C.: The Influence of Recent Research on the Present Etiological Concept of Malocclusion, AM. J. ORTHODONTICS 34: 192-200, 1948.
31. Wylie, W. L.: Malocclusion—Malady or Malformation, Angle Orthodontist 19: 3-12, 1949.
32. Cohen, M. M.: Clinical Studies in the Development of the Dental Height, AM. J. ORTHODONTICS 36: 917-932, 1950.
33. Scott, J. H.: The Variability of Cranial and Facial Dimensions, Excerpta medica (Anat.) 8: #1 195 (Abst.), 1954.

34. Iwagaki, H.: Hereditary Influence of Malocclusion, AM. J. ORTHODONTICS AND ORAL SURG. 24: 328-336, 1938.
35. Rubbrecht, O.: A Study of the Heredity of the Anomalies of the Jaws, AM. J. ORTHODONTICS AND ORAL SURG. 25: 751-779, 1939.
36. Wylie, W. L.: A Quantitative Method for the Comparison of Craniofacial Patterns in Different Individuals: Its Application to a Study of Parents and Offspring, Am. J. Anat. 74: 39-60, 1944.
37. Hooten, E. A.: Anthropometry and Orthodontics, AM. J. ORTHODONTICS AND ORAL SURG. 32: 673-681, 1946.
38. Curtner, R. M.: Predetermination of the Adult Face, AM. J. ORTHODONTICS 39: 201-217, 1953.
39. Ikeda, J.: Head Measurements in the Light of Familial Influences, Excerpta medica (Anat.) 8: #2031 (Abst.), 1954.
40. Lewis, S. J.: Thumb Sucking, a Cause of Malocclusion of the Teeth, J. Am. Dent. A. 17: 1060-1073, 1930.
41. Fischer, R. A.: The Correlation Between Relatives on the Supposition of Mendelian Inheritance, Trans. Roy. Soc. Edinburgh 52: 339-433, 1918.
42. Hogben, L.: The Limits of Applicability of Correlation Technique in Human Genetics, J. Genetics 27: 379-406, 1933.

AN ANATOMIC ANOMALY OF THE MAXILLARY LABIAL FRENUM

ROBERT E. CROWLEY, D.D.S., MONTROSE, N. Y.

AT THIS hospital, we have been carrying out an extensive dental research program under the auspices of Central Office in Washington, D. C. Part of this study was a detailed reporting of oral findings. While carrying out this diagnostic phase of the study, it was noted that in some patients the labial maxillary frenum had a small tissue tag growing from the free edge. At first this was considered an individual oddity of no particular significance, but a record of its occurrence and appearance was kept in accordance with our statistical research. It soon appeared that the rate of occurrence was much higher that had been expected, and we decided to make a more comprehensive study, including the gross and histologic appearance of this anomaly and a record of its distribution in our hospitalized patients. This report is the result of our initial study.

As already indicated, this tissue tag arose from the anterior free border of the labial frenum of the maxilla. Usually it was of a triangular shape, tapering from a broader base to a pointed tip. It was flattened from side to side and varied in size, the larger specimens being 5 mm. in length. While most of the tags followed this description, there were numerous examples of deviations, a common one being that in which the tissue appeared as an elongated, fingerlike projection, which was more elipsoid in cross section. A superficial examination would seem to indicate that the majority of these tags were found to be closer to the lip side of the frenum's attachment than to the frenum's attachment at the alveolar ridge. However, upon lifting the lip and putting the frenum under stretching tension, the location was found to be more central, although still slightly favoring the portion of the frenum toward the lip. However, variations of position along the frenum were encountered (Figs. 1 and 2).

In addition to this tag, another finding was the occurrence of a nodule at the point of insertion of the frenum on the maxillary ridge. Unlike the tag, this attachment nodule was not as freely projecting. It was generally smaller in size and appeared firm and of a whitish color. Histologically, it consisted of a covering epithelium and a fibrous stroma. This fibrous tissue appeared more dense when compared with the stroma found in the tissue tag. The nodule was found to occur both with and without the tissue tag, and it is believed that it arises differently from the frenal tag (Fig. 3).

From Veterans Administration Hospital, Montrose, New York.

In the case of the tissue tag, the identifying criterion—a definite bit of tissue projecting beyond the free edge of the frenum—gave a clear-cut basis for the identification and, hence, a definite present or absent rating whereby its occurrence could be tabulated. In the case of the attachment nodule, recognition was undependable. The terminal portion of the frenum in this area is frequently thickened and of a whitish appearance, presenting a problem in differentiating the smaller nodules against this normal but masking appearance. We felt, therefore, that a study of its occurrence could result

Fig. 1.

Fig. 2.

Fig. 3.

Figs. 1 and 2.—Typical specimens of tissue tags in maxillary labial frena.
Fig. 3.—Frenum with both an attachment nodule where frenum joins ridge and a tissue tag projecting from the margin of the frenum.

only in figures of questionable value and decided not to pursue this particular element further except to note its occurrence and to discuss its possible origin in the latter part of this article.

Returning to the tissue tag, its base where it joined the frenum was not demarcated in appearance from the normal tissue. The lateral surfaces likewise showed a normal mucosal appearance. Toward the free-hanging tip, the

tissue sometimes was more whitish in color and in some cases showed a firmness to the touch when compressed between the fingers, indicating a more fibrous structure. Clinical examination revealed no signs of any inflammatory growth or neoplastic activity in this tissue. Neither was there any obvious inflammatory response, although it might have been expected that, in some of these larger tags, traumatic irritation might have been found. Its absence could be attributed to the fact that the tag normally lay folded along the side of the frenum and under the protection of the upper lip.

Presence of the tag was not related to any abnormality in the size or position of the frenum itself. It was found on some fairly large frena as well as on the narrow, thin type. The height of the point of insertion of the frenum on the alveolar ridge was not related to the occurrence of this anomalous tag. In patients with teeth, no relationship was found in the occurrence of the tissue tag and any tendency toward disharmony of position of the upper anterior teeth, nor was there any correlation between its occurrence and a tendency toward a diastema between the upper central incisors. This tag was also encountered where the upper anterior region of the jaw was edentulous or where the entire jaw was edentulous. It was found in both young and old persons, and in both males and females.

Biopsy of a variety of these tags was made. The procedure was carried out under local anesthesia, and a fine-gauge needle was introduced into the deeper tissue of the frenum itself, so as to eliminate or minimize any distortion in the tissue to be studied due to the pressure or activity of the deposited anesthetic. The tissue tag was then held by a small tissue forceps and, with a scalpel, an incision was made wide of the base and the tissue tag was dissected free, making certain that the line of severance was well into the frenum tissue proper.

Examined microscopically, it appeared as normal mucosal tissue with a typical stratified squamous epithelium forming its outer surface. In some specimens the epithelium was slightly corrugated, and in others there were tiny rete pegs; a few specimens showed a parakeratosis. The core under the covering epithelium was a vascular fibrous tissue varying in density, some specimens being of loose construction and organization and others showing a more compact fibrous pattern (Fig. 4). Nerve bundles were observed with tactile bodies near the surface of the tip. In several specimens, a lobulated sebaceous gland opening into a follicle was found. The neck of such a gland was surrounded by a minimal lymphocytic infiltration. Another variation was the presence of a ductlike structure consisting of a pseudo-stratified columnar epithelium with a narrow, circular, fibrous wall. In another specimen, a duct was traced in serial sections from its opening in the outer epithelium back through the underlying submucosa and its division into twelve ancillary ducts lined with lower cells. It had the appearance of a rudimentary salivary gland with a rather long duct.

The rate of occurrence of these labial frenum tissue tags was higher than had been expected initially. In a group of 416 white male patients examined,

101 showed such frenum tags. This is an incidence of about 24 per cent for the group. In the eighty-five male Negro patients examined as a separate group, only one case of such a tissue tag was observed. Furthermore, this patient, although classified as a Negro, showed obvious recent interracial blending in the modification of Negroid features and eye coloring. His surname, too, bore this out, since it was of middle-European origin. In a small group of white female patients, the occurrence of the tag was about 20 per cent. Only a few Negro females were examined, but no tags were found. On this evidence, and despite the small number of Negroes in the study, it would appear that for some reason the occurrence of this anomaly in the Negro is of very low incidence. It is noted further that, in the entire group of 416 white patients surveyed, there were no similar tissue tags found on any other frenum attachments. Even where a large tag was found on the labial frenum

Fig. 4.—Histologic appearance of a section of tissue tag showing presence of a duct.

and might indicate a tendency toward such excrescences of tissue, no tags were found on the other buccal attachments in such mouths. In the Negro group, likewise, no incidences of tissue tags were found on any of the other frena.

It would appear, therefore, that this phenomenon was entirely localized to the upper labial frenum. The relation of an anomaly to a specific anatomic area would seem to argue an associative cause in the background of that particular anatomic site that differentiates it from similar anatomic areas (in this case, the other frena).

Since there is no apparent difference in function between the labial frenum and the others, and since the structure of each is essentially the same, the remaining possibility for accounting for the tissue tag lies in a difference in the developmental background. There is evidence that such a difference

in development exists. It is known that the other frena of the mouth originate in a differential separation of soft tissues in relation to a single bony structure of the face. Thus, the maxillary buccal frenum develops from tissue changes relating entirely to the maxillary bone which is likewise undergoing formation at this time. Similarly, the mandibular buccal frenum is involved in tissue differentiation related only to the mandible. The maxillary labial frenum, however, is found in a more complex developmental setting.

Fig. 5.

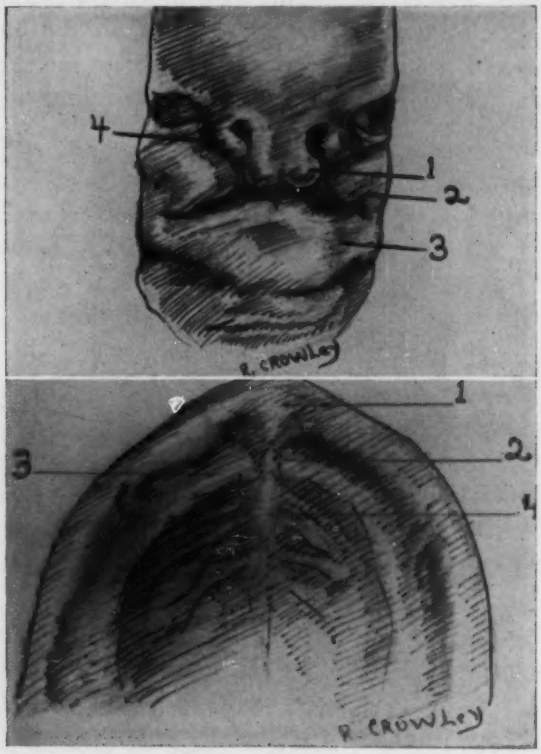


Fig. 6.

Fig. 5.—Drawing showing formation of face in fetus: *1*, Globular process (medial nasal process); *2*, maxillary process; *3*, mandible; *4*, nasolateral process.

Fig. 6.—Drawing of palate showing: *1*, Tubercle of the lip; *2*, the frenum; *3*, alveolar ridge; and *4*, incisive papilla. The frenum extends across the ridge, but the growing alveolar ridge is beginning to encroach upon it and divide it.

The labial frenum is not developed in relation to the maxilla alone. The area of its locale is developed from the downward growth of the medial nasal process. The inferior lateral borders of this process, being somewhat rounded and ball-shaped, are called globular processes. These globular processes descend and come in contact with the developing maxillary process on each side of the anterior region of the face, thus forming the medial anterior portion of the upper jaw (Fig. 5). This development is actually the homologue of the premaxillary bone that is present in other mammals.

Shortly after this union of the maxillary processes with the globular processes, the jaws begin to show changes from a solid mass into a subdivision of lip and gum regions. The initial change is heralded with the appearance of a thickened band of epithelium that forms along this undifferentiated ridge. These epithelial cells grow down into the underlying mesoderm. Later, the central cells of the epithelial band undergo degeneration, resulting in a gradually deepening groove which continues to penetrate until it eventually separates the lip from the gum. The differentiation of these oral structures is generally completed at about the tenth week of fetal life. The anterior labial space thus formed joins with the similar space developing about the cheek formed by the gradual fusion of the extensive oral sulcus into a more restricted mouth opening.

The portion of the upper labial groove which concerns us is that which forms on the globular process which, as noted, makes up the upper anterior region of the mouth. Here, the deepening of the groove takes place on either side of the mid-point and leaves a residual anteroposterior fold of the tissue untouched. This, of course, corresponds to the line of union of the two globular processes and it remains as the tectolabial frenum. It is believed that the tissue tag is a result of an irregularity in this process of resorption. The situation is later modified, particularly after birth, with the growth of the alveolar ridge consequent to the development and eventual eruption of the deciduous teeth.

In contrast to the tissue tag, the attachment nodule would appear to arise essentially from the growth of the alveolar ridge. In the fetus, as the palatine papilla develops, a fold of tissue extends from the papilla across to the so-called tubercle of the upper lip. This is the tectolabial frenum whose origin has just been described. As the alveolar process increases in size between the palate and the lip, this tectolabial frenum is separated from the palatine papilla and persists as the labial frenum (Fig. 6). The alveolar ridge, in a sense, may be considered as cutting across the tectolabial frenum whereby the attachment of this frenum to the ridge is displaced upward along its outer surface. It is believed that the attachment nodule is actually a residue of the frequently nodulelike cord of this tectolabial frenum.

To recapitulate, the medial anterior portion of the upper jaw region is formed from the medial nasal process or globular processes. These give rise to soft tissue structures that include the fleshy nasal septum, the medial part of the lip and gum, and the incisive papilla. Their junction also forms the base upon which the philtrum of the upper lip and labial tubercle, if present, are formed. The later separation of lip from the alveolar ridge leaves, as a residue, the labial frenum. The subsequent growth of the alveolar ridge separates the frenum from the incisive papilla and displaces the frenal attachment upward on the ridge. In these processes, the tissue tags probably arise.

Further information on this complex developmental situation is derived from the comparative anatomy of the anterior oral region as found in animals. Here the upper incisor area constitutes a distinct bone—the premaxilla. This bone adds to the length of the skull, helping to form the characteristic animal

snout. It likewise advances the position of the incisor teeth, putting them in a more forward relationship that facilitates the ready grasping of food. The area's dedication to food-getting is seen further in the fact that the incisive canals on the palate aspect are patent and the related ducts leading to Stenson's organ are functional, the organ itself being, of course, an auxiliary olfactory mechanism.

In man, this region is of less importance. The premaxillary bone is, in fact, absorbed into the architecture of the maxilla and in the mature skull its outlines are obscured, if at all discernible. This de-emphasis leads to a consistent flattening of the facial contours of this region in contrast to the animal snout just described. Likewise, on the palatal aspect, the incisive canals are no longer patent but are covered over, and the nasopalatine ducts and associated Stenson's organ are vestigial. Thus, there has been a complete modification of this area with a loss of the prominence of the premaxillary features. The labial frenum participates in this modification. As Boyd[2] points out, the labial frenum is associated with the prominence of the labial rhinarium in animals. In the lemurs, for example, this rhinarium is well developed and, accordingly, the labial frenum is large and prominent. In the higher primates, however, the process of reduction and de-emphasis of premaxillary features has already begun, and the labial rhinarium is aborted. There is a parallel reduction of the development of the frontal nasal process and, accompanying this, a de-emphasis in these structures marked by a reduction in the size of the labial frenum. It is not unusual, as is known in other areas of the mouth, that where anatomic structures have undergone such modification there are consistent areas of instability which are prone to variation and anomaly.

It is speculative, of course, to assign causes to conditions whose origin have not been directly observed, but it would be compatible with findings in other areas of somatic development to assume that the tissue tag so commonly encountered on the labial frenum represents a residuum of this rather involved differential process through which the medial portion of the upper lip and its associated structures pass. It might, therefore, constitute a small bit of testimony to the resolution of this complex problem confronting the differential growth of this region.

As stated previously, the occurrence of such labial tags in Negro patients was not encountered, except in one case out of eighty-five, and even on the basis of this rather limited sample it could be predicted that the incidence in Negroes would be extremely low. Is there any possible explanation for this variation? A basis may be found in the difference of developmental phase in the two groups. Anatomists have remarked that the development of the alveolar ridges, etc., is more pronounced in the Negro fetus. For example, West[1] found, in his studies, that in comparing the palate surface of the gingivae of a Negro fetus 371 mm. in length and a white fetus 292 mm. in length, even with the Negro fetus being somewhat smaller and younger than the white one, the width of the gum was considerably greater. Furthermore, the greater width was due to the larger size of the lingual portion of the gingiva

that tends to push the labiobuccal portion forward. It is likely that this early and more extensive development and the more protrusive position of the gingiva and ridge may be sufficient to account for the difference observed in the tendency toward the absence of a residual tag. It is noted, as well, that this tendency toward earlier maturity persists and is even reflected in the eruption of the teeth, which is earlier in the Negroes.

There is a contributory support for this view in the difference of the development of the nose in the two races. As was pointed out, the same median nasal process that is involved in the development of the labial frenum also forms the central zone of the nose. In his study on nasal development, Schultz[7] points out that, in three white fetuses examined by him, there was a distinct sulcus medialis apicis nasi. He found none in the case of Negro fetuses. He further remarks that this sulcus is not a rare occurrence in adult white persons but has never been observed in Negroes or Negro fetuses.

In summary, we have presented the description of an anatomic anomaly of the labial maxillary frenum, constituting a residuum of the development of this area. This included a tissue tag hanging or projecting from the free margin of the labial maxillary frenum and a separate entity consisting of a small fibrous nodule found at the point of insertion of the frenum on the maxillary ridge. A description of the gross and microscopic appearance of these tags, as well as their distribution in the group studied, is reported. The finding is not uncommon, being encountered in one out of four or five white persons observed in a group of 416 male white patients. In a separate group of eighty-five male Negroes studied, only one incidence of such a tag was found. This would indicate a very low rate of occurrence in the Negro. The occurrence of the tag only on the labial frenum was attributed to the complex anatomic development of this frenum area as contrasted with the relatively simple development of the other frena. Since no such tags were observed on these other frena, it was believed that the aforementioned complex developmental setting accounted for their existence. The low incidence of such tags in Negroes was explained on the same basis.

REFERENCES

1. West, C. M.: Development of Gums and Their Relationship to the Deciduous Teeth in the Human Fetus, in Contributions to Embryology, Washington, D. C., 1920, Carnegie Institution, Vol. 16, pp. 23-46.
2. Boyd, J. D.: Classification of the Upper Lip in Mammals, J. Anat. 67: 409-416, 1933.
3. Arey, L. B.: Developmental Anatomy, Philadelphia, 1946, W. B. Saunders Company.
4. Patten, B. M.: Human Embryology, Philadelphia, 1946, The Blakiston Company.
5. Ceremello, P. J.: The Superior Labial Frenum and the Midline Diastema and Their Relation to Growth and Development of the Oral Structures, Am. J. Orthodontics 39: 120-139, 1953.
6. Chase, S. W.: The Early Development of the Human Premaxilla, J. Am. Dent. A. 29: 1991-2001, 1942.
7. Schultz, A. H.: The Development of the External Nose in Whites and Negroes, in Contributions to Embryology, Washington, D. C., 1920, Carnegie Institution, Vol. 9.
8. Steggerda, M., and Hill, T.: Eruption of Teeth Among Whites, Negroes, and Indians, Am. J. Orthodontics and Oral Surg. 28: 361-370, 1942.

Editorial

OCCLUSAL MANNERISMS AND RELAPSE OF MANDIBULAR INCISORS

THE relapse or recrowding of mandibular incisor teeth in patients treated with or without extraction is a well-known phenomenon to practitioners of orthodontics. Blame for recrowding of mandibular incisors has been placed on erupting third molars, placement of mandibular incisors in a position of increased procumbency, increased lingual inclination of the mandibular incisors during adolescent growth, nail biting, and other dental pressure habits. All of the foregoing, or any one of them, may be responsible in individual cases, but there are other important reasons.

Erupting third molars long have served as a refuge for the orthodontist confronted by parents of patients who show mandibular incisor relapse. It is always important, of course, to make sure first that the patient has third molars on which to place the blame. We hold with those who believe that third molar eruption is not a factor in mandibular incisor crowding. However, there is an important exception to the foregoing.

Where teeth have been inclined distally by orthodontic means, the presence of erupting third molars interferes with distal root positioning and the eruptive force of the third molars can induce forward shifting of the distally inclined teeth, with resulting recrowding of the incisors. Placing teeth in a more procumbent position, as we have previously pointed out,* may bring them in conflict with the trajectorial forces of the closed "functional system" of the masticatory apparatus. Incisors thus placed outside the "area of tolerance" in orthodontic tooth positioning will show relapse. There is no doubt also that the introduction of untoward forces in nail biting, or biting on other hard objects, and continued finger- and lip-sucking can interfere with the stability of mandibular incisor teeth.

An important factor which has not been given due consideration as a cause of recrowding of mandibular incisor teeth is the position of incisor occlusion assumed by patients involuntarily when they experience a state of stress, anxiety, or total concentration. The accompanying movements of the tongue, mimetic muscles, the mandible, and teeth in a person who is concentrating his entire efforts in performing some unaccustomed or difficult job, whether it is a child learning to write his alphabet or an orthodontist placing a tight-fitting band, are common observances.

*Editorial, AM. J. ORTHODONTICS, June, 1953.

Living, as we do, in what is known as the "Age of Anxiety," these occlusal mannerisms may well become "tic occlusions," and in either case can affect the satisfactory results obtained in orthodontic therapy.

Dorland's dictionary* defines a *tic* as ". . . sudden spasms that are identical with the movements of volitional intent. Tics occur in persons of neurotic tendency, are often hereditary, and usually develop in youth." Mimetic or facial tics are well-known neurologic conditions. We have jaw winkers, mouth twisters, cheek gnawers, and lip biters aplenty. Occlusal mannerisms are even more frequent.

The practicing orthodontist can recognize occlusal mannerisms or "tic occlusion" by observing the incisal edges of the mandibular incisors of his patients. When an occlusal mannerism or "tic occlusion" is present, the incisal edges are worn beyond the point to be expected in a young person and show highly polished facets. Manual manipulation of the relaxed mandible will permit its placement in the mannerism occlusion. In fact, when one asks such a patient to "close the teeth together," it is more than an even chance that the patient will bring his teeth together in the involuntary occlusal mannerism or in "tic occlusion," if one is present.

These involuntary habit or mannerism occlusions we believe to be an important, if not the most common, cause of mandibular incisor crowding and relapse after orthodontic treatment. Elimination of these interferences may well lie outside the scope and ability of the orthodontist to accomplish. Psychiatric cooperation here may well be necessary.

J. A. S.

*Dorland, W. A. N.: The American Illustrated Medical Dictionary, Philadelphia, 1947, W. B. Saunders Company.

Department of Orthodontic Abstracts and Reviews

Edited by
DR. J. A. SALZMANN, NEW YORK CITY

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Abstracts Presented Before the Research Section of the American Association of Orthodontists, San Francisco, May 11, 1955

A Serial Cephalometric Evaluation of Growth of the Face During Orthodontic Treatment in Adolescent Males: By Milford Franks, Jr., Northwestern University Dental School, Orthodontic Department, Chicago, Ill.

A group of eight males, aged 11 to 17 years and presenting moderate skeletal dysplasias, was studied. All were treated orthodontically during the period, although the time and intensity of treatment were not known. There was a steady decrease of the SNa-SNb difference. A decreasing prominence of the denture bases was noted. Marked stability of the y axis of growth was evident during the range. Although its rate of growth was less than those of the facial measurements, the length of the anterior cranial base increased steadily throughout the age range. The stability of the maxillary and mandibular planes in relation to the anterior cranial base was a prominent feature during growth. A general acceleration of growth between ages 13 and 15, and concentrated from 13 to 14, was noted in the linear measurements of the study. It should not be assumed, however, that, because a given male individual has not had his growth spurt by age 17, it will not occur. Facial height increased at a rate one and one-half to two times that of facial depth. A constant proportionality between parts, as evidenced by relatively fixed ratios between linear increments of growth, was characteristic of the sample.

A Study of Morphologic Changes in the Oral Cavity Induced by Eccentric Muscluar Activity in Cerebral Palsy Children: By Gene S. Trausch, D.D.S., Northwestern University, Chicago, Ill.

This study entails a clinical survey of eighty-three white children with cerebral palsy. The purpose of the study is to determine if characteristic anatomic conformations exist in the oral cavities of these individuals. Correlations are made to eccentric muscular activity observed.

The study group is comprised of boys and girls, whose ages range from 3 to 17 years, inclusive. The majority of the subjects are of the spastic and athetoid type.

The method employed in the survey is clinical examination. Collected data consist of the state of facial musculature, tongue function, involuntary tongue thrusts, dental arch form, palatal conformations, tooth inclinations, and open-bites. In selected cases, mandibular and maxillary orthodontic type plaster models (casts) were made, and lateral cephalometric radiographs were taken.

A relationship is shown to exist between eccentric muscular activity and dentoalveolar deviations in many cerebral palsy children. In addition, impaired and missing voluntary tongue functions, and involuntary thrusts, exist. The athetoid child is found to be more severely affected than the other medical types.

An Electromyographic Investigation of the Functioning Perioral and Suprahyoid Musculature in Normal Occlusion and Class II, Division 1 Dysplasia Cases (Read by Title): By Leonard Schlossberg and Stanley C. Harris, Northwestern University Dental School, Chicago, Illinois.

Ten male patients, ranging in age from 10 to 14 years, were selected to serve as subjects. Five normal occlusion cases and five Class II, Division 1 subjects were examined in the designated areas in order to determine whether differences in the functioning muscular patterns could be detected electromyographically between the two groups. In three of the five normal cases, onset of activity was coincident in mental and upper lip areas. Two cases showed some mental activity of increased amplitude before lip function. All five of the dysplasia cases showed early mental activity with increased amplitude, as compared to the upper lip. The normal pattern displayed discrete envelopes with intervening periods of decreased or minimal activity, whereas Class II patients showed a more continuous type of activity in general, with envelopes blending into the band of continued muscular activity. The suprahyoid activity was greatest in the most pronounced Class II cases and least in the most ideal of the normal occlusion group. There was a direct correlation between suprahyoid activity and severity of the malocclusion. All myographs of the physiologic rest position of the lip, mental, and suprahyoid areas, taken when the mandible was also in its physiologic rest position, showed minimal or negligible activity. It also was found that each patient had his own unique pattern, which clearly reappeared on performance of the same exercise a number of times.

The Prevalence of Ectopic Eruption of the Permanent Teeth in Children Between 5 and 10 Years of Age (Read by Title): By Worth M. Byrd, D.D.S., M.S., University of North Carolina, Chapel Hill, N. C.

The purpose in this investigation is to determine, according to age, sex, jaw, tooth, and race, the prevalence of the premature resorption of the roots of the primary teeth due to ectopic eruption of the permanent teeth in children from central and eastern North Carolina. The age range chosen for this study was from 5 to 10 years.

The method used in this investigation was the study of 444 full-mouth intraoral roentgenograms taken from the files of the patients in the Pedodontic Department of the Dental School of the University of North Carolina.

It was found that ectopic eruption occurred in approximately one out of three children between the ages of 5 and 10 years from central and eastern North Carolina. It was also found that this condition centered around the anterior part of the mouth in both the upper and lower jaws. As a result of this investigation, it is felt that one more classification could be added to previous classifications: that is, the ectopic eruption of the permanent central incisors. It was further concluded that additional investigation is needed to determine whether or not this ectopic condition can be avoided by orthodontic means.

Cephalometric Evaluation of Simon's "Law of the Canines" (Read by Title): By John A. Crowley, B.S., D.D.S., M.S., University of North Carolina School of Dentistry, Chapel Hill, N. C.

Simon indicated that in most normal conclusions the orbital plane passes through the maxillary canines. Due to the thirty-year-old controversy concerning this orbital "law of the canines," it was decided to incorporate in this study both Simon's gnathostatic orbital plane and, if found to be different, the craniometric (cephalometric) orbital plane as determined by using living persons.

The midline of the maxillary left canine and Simon's gnathostatic orbital point were marked with radiopaque materials on each subject. A Higley head positioner was used while taking profile cephalograms of forty-seven white male adults, ranging in age from 21 to 32 years, who had normal occlusion and pleasing facial profiles.

A comparison of the tracings of the developed cephalograms showed a mean difference of 7.63 mm. between the gnathostatic and cephalometric orbital points. These two different orbital points produced a gnathostatic orbital plane which passed through the left maxillary canine in 61.7 per cent of the individuals and a cephalometric orbital plane which passed through the left maxillary first premolar in 74.5 per cent of the individuals.

The relation of the gnathostatic orbital plane to the maxillary dentition, on live subjects, in this study is similar to previous research results on gnathostatic casts conducted on live subjects, and supports Simon's contentions relative to the so-called "law of the canines."

A Longitudinal Study of Change in a Mandibular Bimolar Diameter Before and After Eruption (Read by Title): By George E. Mindeman, D.D.S., M.S., State University of Iowa, Iowa City, Iowa.

This reports a study of dental arch width in the region of the mandibular permanent first molars on white children 4 years to 9 years of age. The data were accumulated on twenty-one boys and twenty-two girls of northwest European ancestry and above-average socioeconomic status, residing in the Iowa City, Iowa, area.

Selected findings are:

1. The calcification of the crowns of the mandibular permanent first molar teeth was complete or near enough to completion to be beyond the widest portion of the buccal surface in all the subjects studied at 4 years of age.

2. It is possible to make reliable measurements on posteroanterior cephalometric roentgenograms with the aid of a mathematical correction formula to compensate for x-ray distortion.

3. The curves produced by plotting the mean measures of bimolar arch width at successive ages for each sex are smooth for both sexes.

a. The width means of both sexes demonstrate a linear decrease in magnitude of slightly more than 1 mm. per year from 4 to 6½ years of age.

b. From 6½ to 8 years of age the magnitude of the reduction of mean arch width decreases in both sexes. This decrease amounts to less than 1 mm.

c. From 8 years to 9 years of age, the mean arch width measures in both sexes slightly increase in magnitude. The increase, which was slightly larger for the male subjects but statistically not significant, was less than 0.4 mm.

d. The total decrease in magnitude of bimolar arch width from 4 to 9 years of age for the male subjects is 6.0 mm. or 9.7 per cent of the mean bimolar width at 4 years. The total decrease for the female subjects is 6.2 mm., or 10.5 per cent of the mean bimolar width at 4 years of age.

e. The mean sex differences of bimolar widths at comparable ages are statistically significant.

4. The mean eruption times of the mandibular permanent first molars are 6.7 years for the male subjects and 6.5 years for the females. The mean sex difference of 0.2 years is not statistically significant.

5. Clinical eruption of the molar crown may be a factor in the change of bimolar width.

6. There are magnitude and rank order changes among the subjects of each sex at successive ages. The correlation of measures at 4 and at 9 years of age for the male subjects was 0.6 and the correlation of measures for the female subjects at 4 and at 9 years of age was 0.8.

7. The differences of the mean measures of bimolar arch width found in this investigation and of those by Woods are not statistically significant.

A Practical Approach to Skeletal Age (Read by Title): By Richard G. Scherer, D.D.S., M.S., University of North Carolina, Chapel Hill, N. C.

This study developed from the need for a simple, quick, accurate, and practical way of determining skeletal age of dental patients. Since the concept of skeletal age is based on centers of ossification, an attempt was made to select the minimum number which would provide the most reliable estimate and still be of practical value.

The centers studied were: the appearance of all the carpal bones, except the pisiform; the distal epiphysis of the ulna; the styloid process of the ulna; and the proximal sesamoid of the thumb.

It has been determined in the past that onset of ossification is a useful criterion of skeletal development and, by the accurate use of this criterion, the approximate skeletal age of the patient can be established. If skeletal age be advanced or retarded, it is possible that there are genetic, pathologic, endocrine, or nutritional conditions present.

Roentgenograms of the left hands of 300 public school children of northeastern North Carolina were taken, and as uniform procedures as possible were maintained.

As a result of this study, it was possible to produce charts which, if accepted as normal standards, would serve to establish the approximate skeletal age of dental patients. The fact that girls show a definite acceleration in bone growth over boys was further substantiated.

A Serial Cephalometric Study of Children at 12 and 16 Years of Age Having Excellent Occlusions (Read by Title): By Jerold D. Schulz, D.M.D., M.S., University of Washington, Seattle, Wash.

This study evaluated serial cephalometric films of the skeletal and denture patterns of a group of ten girls and eleven boys between the ages of 12 and 16. All subjects had excellent occlusion. Angular measurements, as proposed in the Downs analysis, and linear measurements to comomnly accepted points were used. Statistical means were calculated for each age group and the significance of the difference between the age groups within the same sex was calculated. Differences in growth were noted between the sexes.

It was noted that the size of the sample is an important consideration when determining growth changes by statistical methods. The skeletal pattern of both sexes was found to have changed in positional relationship, such as an increase in mandibular protrusion and a decrease in the convexity of the facial profile. The study also showed that the downward growth of the mandible was greater at the condyle than at symphysis and the forward growth of the mandible was greater than that of the maxilla. This study was unable to show any statistically significant changes in the denture pattern for either sex in the age range studied. That the relative growth of the boys is greater in all directions than that of the girls was also found for this age period.

Growth changes between the age groups indicated that the boys have been evaluated during a rapid growth period, whereas the girls indicated little growth. The angular changes evident seem to maintain esthetic harmony of the face during growth.

A Cephalometric Evaluation of Morphologic Variations Presented by the Anomaly, Open-Bite: By Theodore K. Wendorff, B.S., D.D.S., M.S.D., University of Washington, Seattle, Wash.

This study was a statistical evaluation of findings obtained from a series of cephalometric radiographs of individuals presenting the anomaly, open-bite. The control group consisted of forty-one persons having no open-bite and presenting some other type of malocclusion. The test group consisted of forty-five persons subdivided into three groups according to the amount of open-bite they presented (distance from the lower incisal edge until contact with the maxillary central incisor or palate range was from 1 mm. to 11 mm.).

Comparable measurements were made in all individuals, means were established, and the test group, with its subdivisions, was contrasted with the control group. Results of the analysis did not corroborate earlier reports that open-bites were associated with either a short ramus, larger gonial angle, or some other cranial deviation apart from the norm.

A wide range of variation was present within all groups contrasted. Supraeruption of the buccal segments of teeth, especially that of the maxilla, was generally associated with the anomaly. Also present in the findings was a substantial increase in the anterior lower face height, with no increase in anterior denture heights. Evidence would tend to support a theory that perverted habit patterns are largely responsible for this condition and that through these patterns buccal segments are not in their normal opposition and are free to supraerupt, thereby leaving the space open anteriorly.

(Additional abstracts presented before the Research Section of the American Association of Orthodontists in May, 1955, will appear from time to time in forthcoming issues of the Journal.)

News and Notes

American Association of Orthodontists Entertainment and Recreation in Boston

Monday, April 30, is the date of the Golden Anniversary Luncheon honoring the fifty-year members; in the evening the "Get Acquainted" cocktail party and dinner for members and ladies will be held.

Tuesday, May 1, 8:30 P.M. Boston Symphony Orchestra, opening night of "Pops Concerts" under the direction of Arthur Fiedler, conductor. A limited number of tickets are available which will be allocated in the order for which they are applied.

Wednesday noon, May 2, the Round Table Discussion Luncheon will be held combining fellowship and scientific discussion.

Wednesday evening, May 2, there will be the president's reception, dinner, floor show, and dance.

For the Ladies:

Monday, April 30, through Wednesday, May 2. Complimentary Continental Breakfast for the ladies from 9:00 A.M. to 10:30 A.M.

Monday, April 30. "Get Acquainted" cocktail party and dinner for members and ladies (as above).

Tuesday afternoon, May 1. Tour to Wayside Inn, Sudbury, and to Concord and Lexington. (Members who are not attending the Research Section meeting may participate in this tour.)

Tuesday, May 1, 8:30 P.M. Boston Symphony Orchestra, opening night of "Pops Concerts" (as above).

Wednesday, May 2. Luncheon and fashion show at the University Club. (The University Club is two and one-half blocks from Hotel Statler. Transportation will be provided from the Statler to the University Club.)

Wednesday evening, May 2. President's reception, dinner, floor show, and dance (as above).

1956 Prize Essay Contest, American Association of Orthodontists

Eligibility.—Any member of the American Association of Orthodontists and any person affiliated with a recognized institution in the field of dentistry or associated with it as a teacher, researcher, undergraduate, or graduate student shall be eligible to enter the competition.

Character of Essay.—Each essay submitted must represent an original investigation and contain some new significant material of value to the art and science of orthodontics.

Prize.—A cash prize of $500.00 is offered for the essay judged to be the winner. The committee, however, reserves the right to omit the award if, in its judgment, none of the entries is considered to be worthy. Honorable mention will be awarded to those authors taking second and third places. The first three papers will become the property of the American Association of Orthodontists and will be published. All other essays will be returned.

Specifications.—All essays must be in English, typewritten on 8½ by 11 inch white paper, double spaced with at least 1 inch margins. Each sheet must be numbered and

bound or assembled with paper fasteners in a "brief cover" for easy handling. Three complete copies of each essay, including all illustrations, tables, and bibliography, must be submitted. The name and address of the author must not appear in the essay. For purpose of identification, the author's name, together with a brief biographical sketch which sets forth his or her dental and/or orthodontic training, present activity, and status (practitioner, teacher, student, research worker, etc.) should be typed on a separate sheet of paper and enclosed in a sealed envelope. The envelope should carry the title of the essay.

Presentation.—The author of the winning essay will be invited to present it at the meeting of the American Association of Orthodontists to be held at the Statler Hotel, Boston, Massachusetts, the week of April 29, 1956.

Judges.—The entries will be judged by the Research Committee of the American Association of Orthodontists.

Final Submission Date.—No essay will be considered for this competition unless received in triplicate on or before Jan. 10, 1956, by Dr. Thomas D. Speidel, University of Minnesota, School of Dentistry, Minneapolis 14, Minnesota.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

American Association of Orthodontists, 1956 Research Section Meeting

Continuing the policy of recent years, the program will consist of a series of ten-minute research reports which may be presented orally or read by title only. All persons engaged in research are urged to participate in this program, which will be held on April 29 and 30 and May 1 and 2, 1956, in the Statler Hotel, Boston, Massachusetts.

Each participant is asked to prepare a 250-word abstract for publication in the AMERICAN JOURNAL OF ORTHODONTICS. Abstract for publication and the ten-minute oral presentation at the meeting should be carefully prepared to present an adequate description of the import of your investigation.

Forms for use in submitting the title and 250-word abstract of your research will be sent to each dental school orthodontic department and to any individual requesting one. Please send your title and abstract as early as possible, but not later than Jan. 10, 1956, to Dr. J. William Adams, 707 Bankers Trust Bldg., Indianapolis 4, Indiana.

H. I. Margolis, Chairman, Research Committee
American Association of Orthodontists
311 Commonwealth Ave.
Boston 15, Massachusetts

American Board of Orthodontics

The next meeting of the American Board of Orthodontics will be held at the Statler Hotel in Boston, Massachusetts, April 24 through April 28, 1956. Orthodontists who desire to be certified by the Board may obtain application blanks from the secretary, Dr. Wendell L. Wylie, University of California School of Dentistry, The Medical Center, San Francisco 22, California.

Applications for acceptance at the Boston meeting, leading to stipulation of examination requirements for the following year, must be filed before March 1, 1956. To be eligible, an applicant must have been an active member of the American Association of Orthodontists for at least three years.

European Orthodontic Society

The European Orthodontic Society will hold its thirty-second congress Aug. 9 to 13, 1956, at the Grand Hotel in Stockholm, Sweden. Members of the American Association of Orthodontists who are going to visit Europe next summer are cordially invited to attend the meeting and also to take part in the program. Papers and demonstrations are promised from well-known European and American orthodontists.

Birger Kjellgren, President
Eastmaninstitutet, Stockholm Va.
Sweden.

Notes of Interest

Dr. Milton B. Asbell announces the removal of his office to 25 Haddon Ave., Camden, New Jersey, practice limited to orthodontics.

Samuel C. Arkway, D.D.S., and Arthur I. Thomas, D.D.S., announce their association at 137 East State St., Westport, Connecticut, practice limited to orthodontics.

Michael J. Frantz, D.D.S., and William L. Lawther, D.D.S., announce their association and the opening of their office at 554 Broadway Ave., Lorain, Ohio, practice limited to orthodontics.

Arthur Hader, D.D.S., announces the opening of his office at 735 Pelham Parkway North, Bronx, New York, practice limited to orthodontics.

Brewer E. Phillips, D.D.S., announces the opening of his office for the practice of orthodontics, Suite 204, 9210 South Colima Rd., Friendly Hills Medical Center, East Whittier, California.

Elliott Silverman, D.D.S., announces the opening of his office at the northeast corner of Montpelier and Atlantic Avenues, Atlantic City, New Jersey, practice limited to orthodontics.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

American Association of Orthodontists

President, Philip E. Adams - - - - - - - - - 170 Marlborough St., Boston, Mass.
President-Elect, A. C. Broussard - - - - - - Maison Blanche Bldg., New Orleans, La.
Vice-President, Stephen Hopkins - - - - - - - - 1746 K St., N.W., Washington, D. C.
Secretary-Treasurer, Franklin A. Squires - - - - - Medical Centre, White Plains, N. Y.

Central Section of the American Association of Orthodontists

President, Richard A. Smith - - - - - - - - - 9401 Ridgeway Ave., Evanston, Ill.
Secretary-Treasurer, William F. Ford - - - - - - - 575 Lincoln Ave., Winnetka, Ill.

Great Lakes Society of Orthodontists

President, Milton R. Culbert - - - - - - - 73 Warren Rd., Toronto, Ontario, Canada.
Treasurer, Russell E. Huber - - - - - - - - 350 Fidelity Bank Bldg., Dayton, Ohio.
Secretary, H. I. Miller - - - - - - - - - 1416 Mott Foundation Bldg., Flint, Mich.

Middle Atlantic Society of Orthodontists

President, Daniel E. Shehan - - - - - - - - - Medical Arts Bldg., Baltimore, Md.
Secretary-Treasurer, Paul Deems - - - - - - - - - 835 Park Ave., Baltimore, Md.

Northeastern Society of Orthodontists

President, Eugene J. Kelly - - - - - - - - - 455 W. State St., Trenton, N. J.
Secretary-Treasurer, Wilbur J. Prezzano - - - - Medical Centre, White Plains, N. Y.

Pacific Coast Society of Orthodontists

President, Arnold E. Stoller - - - - - - - - Medical Dental Bldg., Seattle, Wash.
Secretary-Treasurer, Raymond M. Curtner - - - - 450 Sutter St., San Francisco, Calif.

Rocky Mountain Society of Orthodontists

President, Richard Harshman - - - - - - - - - 2402 Broadway, Scotts Bluff, Neb.
Secretary-Treasurer, Howard L. Wilson - - - - - - Republic Bldg., Denver, Colo.

Southern Society of Orthodontists

President, William Jarrett - - - Kanawha Banking and Trust Bldg., Charleston, W. Va.
Secretary-Treasurer, H. K. Terry - - - - - - - 2742 Biscayne Blvd., Miami, Fla.

Southwestern Society of Orthodontists

President, Ott L. Voigt - - - - - - - - - - - - 4115 Fannin, Houston, Texas.
Secretary-Treasurer, Harold S. Born - - - - - - 908 S. Johnstone, Bartlesville, Okla.

American Board of Orthodontics

President, C. Edward Martinek - - - - - - - - 661 Fisher Bldg., Detroit 2, Mich.
Vice-President, Ernest L. Johnson - - - - - - 450 Sutter St., San Francisco 8, Calif.
Secretary, Wendell L. Wylie - - - - - University of California School of Dentistry, The Medical Center, San Francisco 22, Calif.
Treasurer, Lowrie J. Porter - - - - - - - - - 41 East 57th St., New York, N. Y.
Director, William R. Humphrey - - - - - - - - - Republic Bldg., Denver, Colo.
Director, L. Bodine Higley - - - - University of North Carolina, Chapel Hill, N. C.
Director, Jacob A. Salzmann - - - - - - - - 654 Madison Ave., New York, N. Y.

There is an apparent discrepancy

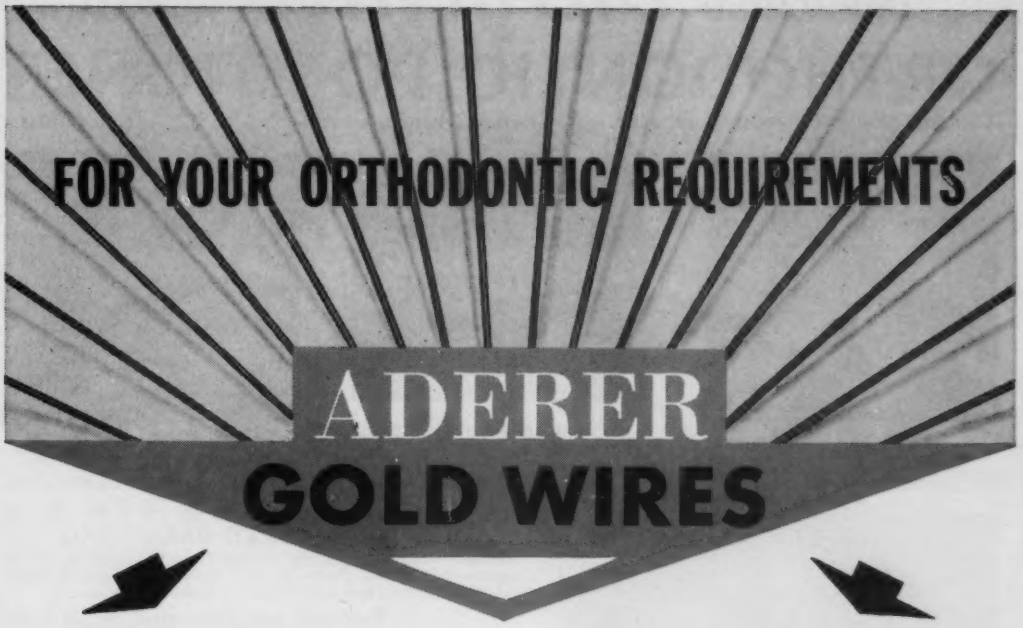
The pages are either missing or t

The filming is recorded as the bo

ıncy at this point.

or the pagination is incorrect.

e book is found in the collections.



ADERER NO. 4 WIRE:

This high-fusing platinum gold alloy provides great strength, elasticity and pliability. It is highly recommended for base wire, main and auxiliary wires such as finger springs — and for applications requiring a high degree of elasticity.

ADERER NO. 3 WIRE:

This is one of the finest wires available. It is an alloy of platinum and gold, well-adapted for orthodontic work. Despite its lower cost, it is high-fusing, has the same elastic qualities as No. 4 Wire but offers slightly less resistance to rupture.

ADERER NO. 1 WIRE:

A platinum-gold alloy wire used successfully for the same purposes as No. 4 Wire and with the same technique. Although its fusion temperature is somewhat lower than No. 4, it still may be used with any good grade of solder. The properties of No. 1 Wire are superior to many competitive higher-priced wires.

MULTI-ORTHO WIRE:

Here, low cost and low specific gravity provide advantageous economy in a high-fusing wire with exceptionally fine tempering qualities.

ADERER WIRES ARE AVAILABLE IN ALL GAUGES AND SHAPES—ROUND, HALF-ROUND, SQUARE AND RECTANGULAR

PHYSICAL PROPERTIES OF ADERER GOLD ORTHODONTIC WIRES

NAME	ULT. TENSILE STRENGTH	PROPORTIONAL LIMIT	FUSION TEMP. °F	ELONGATION IN 2"	YIELD PT. STRAIN	COOLING PERIOD MIN.	COLD BENDS
ADERER NO. 4 WIRE	114,500 Q 153,400 OC	74,400 117,600	1877	18 6.5	.00735	30	5.5 3.5
ADERER NO. 3 WIRE	108,300 Q 150,500 OC	63,600 107,500	1835	23 6.	.0076	30	5 2.5
ADERER NO. 1 WIRE	110,000 Q 173,500 OC	60,000 110,000	1762	19 5.5	.0069	30	5 2.5
MULTI-ORTHO WIRE	92,400 Q 130,400 OC	63,000 110,600	1710	18 3	over .0085	30	4 2.5

ADERER GOLDS
Julius Aderer, Inc., New York · Chicago

JULIUS ADERER, INC. • 219 E. 44th ST., N. Y. • 55 E. WASHINGTON ST., CHICAGO

IMPROVED *Acrycett* APPROVED

ORTHODONTIC POSITIONER

The only positioner constructed of flexible plastic and incorporating unique hard occlusal insert

I. After bands are removed.

II. "Set-up" by Acrycett from which appliance is constructed.

III. Appliance in position.

An Approved Appliance to Assure Your Cases an Aesthetic Functional and Successful Completion

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

CONTROL MOUTH BREATHING

Reduce common respiratory infections of childhood with proper breathing. Promote chest muscle and lung development with the Acrycett Mouth Breathing Eliminator.

Patented and Protected

Full information available upon request.

Acrycett

634 S. Western Ave. Ph: DUnkirk
Los Angeles 5, Calif. 8-3914

NADL National Association of Dental Laboratories

For *Directed and Controlled* Force the proven, widely accepted *Steiner Headgear*

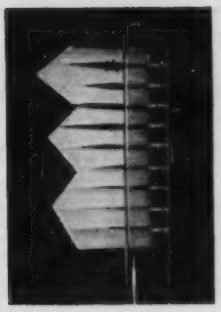
1. Direction of force varied by simple adjustments.
2. Amount of force varied as desired by selection of standard types of ligatures.
3. Maximum patient cooperation assured because of ease of application and use.
4. Can be used repeatedly by sterilization of button mechanism, and replacement of ribbon assembly at a very nominal cost.
5. Precision workmanship guaranteed.

Brochure and price information on request

SPECIALIZING IN RETAINING APPLIANCES AND MODELS

OLYMPIC LABORATORIES

Serving the Orthodontist exclusively for over 20 years
995 SOUTH WESTERN AVE., LOS ANGELES 6, CALIFORNIA
Phone: REpublic 3-1658



The NEW short bristle

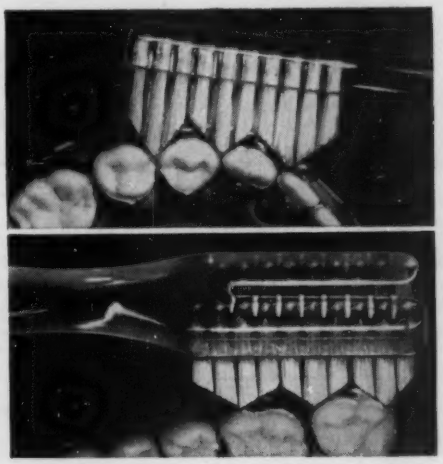
BI-PO "shorty"

ORTHODONTIC

Contour-trim multituft

- Spaced to clear wires
- Long end-tuft for picking
- Reaches second molars
- Children like it

Other models: Dual Action, *flat trim*... General, *separated tufts*

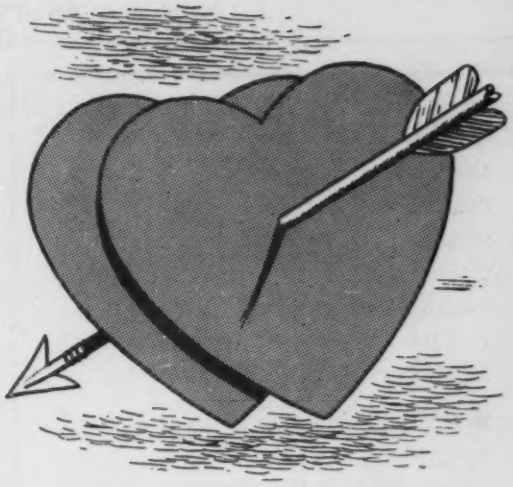


Free sample on request

Send your druggist's name & address.
For professional rate, order from
UNITEK CORP., 275 N. Halstead Ave.
Pasadena 8, California

BI-PO
ORTHODONTIC

BI-PO COMPANY, Box 737, Palo Alto, Calif.



Happy Fastening!

When it comes to making hearts cling together, we doff our hat to Dan Cupid and his darts. When it comes to making appliances cling to teeth, however, we doff our hat to no one. Without a single qualification or concession, we say this: S-C Cement is the finest, holdingest dental cement you can get at any price.

You be the judge, yourself—at our expense. We'll be happy to send you a FREE SAMPLE of S-C Cement if you'll send us the coupon below. Mail it in your professional envelope, please.

S-C CEMENT

A FREE BOOKLET that gives "The Low-Down on a High Quality Dental Cement" is available. If you would like a copy of this informative publication, check the attached coupon.

OJ

STRATFORD-COOKSON COMPANY
261-63 South 3rd Street, Phila. 6, Pa.
Please send me the following, without any charge or obligation:

☐ S-C CEMENT Sample ☐ CEMENT Booklet

Dr. .....

Address .....

.....

Stainless Steel Precision Finished

Orthodontic Instruments and Pliers

Made in the U. S. of A. from domestic materials. Complete Assortments for every technique.

HENRY W. GENERAL, 1309 S. RAILROAD AVE., SAN MATEO, CALIFORNIA

Direct Mail Retail Distributor Since 1945

- The Margolis Cephalostat, the X-ray Fixator and the Camera Mount are now being constructed and distributed by the College of Engineering in conjunction with the Cleft Palate Institute of the School of Dental Medicine of Tufts University.
- Information may be obtained by addressing inquiries to: Professor E. Leavitt, Department of Mechanical Engineering, Tufts University, Medford 55, Massachusetts.
- It should be emphasized that the construction and distribution of this equipment is strictly on a non-profit level on the part of Tufts University and those individuals associated with the University.

INDEX TO ADVERTISERS

Please mention "American Journal of Orthodontics" when writing to our advertisers—it identifies you.

Acrycett ---------- 18
Aderer, Inc., Julius ---------- 17
Arch Manufacturing Company, Henry ---------- 10

Baker & Company, Inc. ---------- 1
Barger Box & Printing Corporation ---------- 20
Betta Orthodontic Supplies ---------- 3, 7, 9
Bi-Po Company ---------- 19
Bruder, Leo L. ---------- 20

General, Henry W. ---------- 20

Klippert Company, The ---------- 12

LaPorte T-P Laboratories ---------- 14, 15

Ney Company, The J. M. ---------- 13

Olympic Laboratories ---------- 18
Orthodontic Specialties Laboratory ---------- 4
Orthodontist Associate Wanted ---------- 20

Rocky Mountain Metal Products Company ---------- 8, 16

Stratford-Cookson Company ---------- 19

Thrombley, Gilbert W. ---------- 11
Thurrow Cephalostat—For Sale— ---------- 20
Tufts University ---------- 20

Unitek Corporation ---------- 5

White Dental Manufacturing Company, The S. S. ---------- Fourth Cover
Williams Gold Refining Company, Inc. ---------- Second Cover

ASSOCIATE WANTED for partnership in New Jersey Orthodontic practice. State personal and professional qualifications. Please reply Box WW, American Journal of Orthodontics, 3207 Washington Blvd., St. Louis 3, Missouri.

FOR SALE: Thurrow Cephalostat purchased recently in perfect condition: Price $350.00. Please reply to Box FH, American Journal of Orthodontics, 3207 Washington Blvd., St. Louis 3, Missouri.

NOW READY!

PRACTICAL PROCEDURES WITH THE TWIN WIRE APPLIANCE

DR. CLAIRE K. MADDEN

This is the course that Dr. Madden gave at Columbia University and Utrecht, Holland

$8.00

Send order with remittance to:

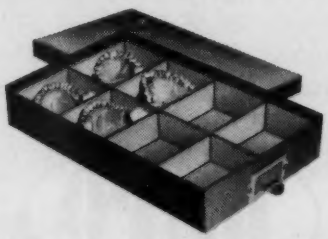
LEO L. BRUDER

1 DeKalb Ave., Dept. 66, Brooklyn 1, N. Y.

Specializing in out of print Dentistry

The BARGER MODEL BOX

FOR STORAGE OF DENTAL CASTS



BARGER BOX & PRINTING CORPORATION

ELKHART, INDIANA

Free Sample and Prices Upon Request

AMERICAN JOURNAL OF ORTHODONTICS

Published by THE C. V. MOSBY COMPANY, 3207 Washington Blvd.
St. Louis 3, U. S. A.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter

Published Monthly. Subscriptions may begin at any time.

Official Publication of The American Association of Orthodontists,
its component societies and The American Board of Orthodontics

Editor-in-Chief

H. C. Pollock, St. Louis, Mo.

Assistant Editor—Earl E. Shepard, St. Louis, Mo.

Editor of Abstracts and Reviews—J. A. Salzmann, New York, N. Y.

Sectional Editors

Charles R. Baker, Evanston, Ill.
Henry D. Cossitt, Toledo, Ohio
Joseph D. Eby, New York, N. Y.
William E. Flesher, Oklahoma City, Okla.
Henry F. Hoffman, Denver, Colo.
Stephen C. Hopkins, Washington, D. C.
James D. McCoy, Beverly Hills, Calif.
Oren A. Oliver, Nashville, Tenn.

EDITORIAL COMMUNICATIONS

Original Communications.—Manuscripts for publication and correspondence relating to them should be sent to Dr. H. C. Pollock, 8015 Maryland Ave., St. Louis 5, Mo., U. S. A.

Manuscripts should be typewritten on one side of the paper only, with double spacing and liberal margins. References should be placed at the end of the article and should include, in the order given, name of author, title, journal, volume, pages, and year; e.g., Smith, E. J.: Children's Dentistry, Am. J. Orthodontics 34: 1-25, 1947. Illustrations accompanying manuscripts should be numbered, provided with suitable legends, and marked lightly on back with author's name. Articles accepted for publication are subject to editorial revision. Neither the editors nor the publishers accept responsibility for the views and statements of authors as published in their "Original Articles."

Illustrations.—A reasonable number of halftone illustrations will be reproduced free of cost to the author, but special arrangements must be made with the editor for color plates, elaborate tables or extra illustrations. Copy for zinc cuts (such as pen drawings and charts) should be drawn and lettered only in India ink, or black typewriter ribbon (when the typewriter is used). Only good glossy photographic prints should be supplied for halftone work; original drawings, not photographs of them, should accompany the manuscript.

Books for Review.—Only such books as are considered of interest and value to subscribers will be reviewed, and no published acknowledgment of books received will be made. These should be sent to Dr. J. A. Salzmann, 654 Madison Ave., New York City.

Reprints.—Reprints of articles must be ordered directly through the publishers, The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo., U. S. A., who will send their schedule of prices. Individual reprints of an article must be obtained through the author.

BUSINESS COMMUNICATIONS

Business Communications.—All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3207 Washington Blvd., St. Louis 3, Mo.

Subscription Rates.—United States and its Possessions $10.00, Students $5.00; Canada, Latin-America, and Spain $10.50, Students $5.50; Other Countries $11.00, Students $6.00. Single copies, $1.75 postpaid. Remittances for subscriptions should be made by check, draft, post office or express money order, payable to this Journal.

Publication Order.—The monthly issues of this Journal form one volume a year; the index is in the December issue.

Change of Address Notice.—Six weeks' notice is required to effect a change of address. Kindly give the exact name under which a subscription is entered, and the full form of both old and new addresses, including the post office zone number.

Advertisements.—Only articles of known scientific value will be given space. Forms close first of month preceding date of issue. Advertising rates and page sizes on application.

Bound Volumes.—Publishers' Authorized Bindery Service, 308 West Randolph Street, Chicago 6, Illinois, will quote prices for binding complete volumes in permanent buckram.

THE DENTIPHORE

An instrument used in making oriented dental casts. These oriented casts provide a practical method for recording and diagnosing of dento-facial and dental asymmetries met in dental practice generally and in orthodontic practice specifically.

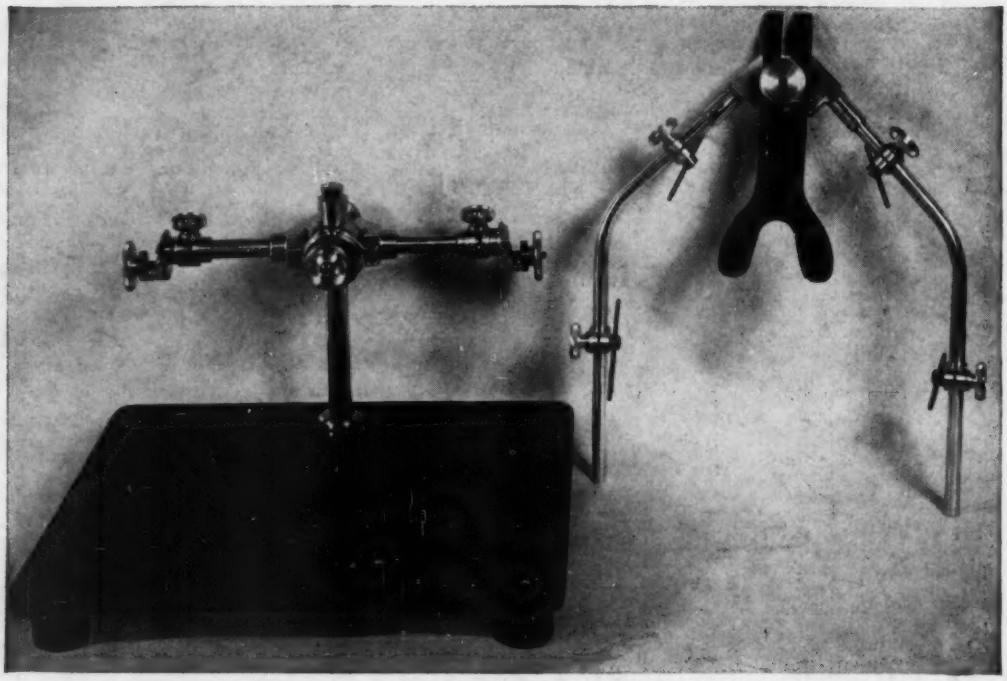
The advantages to be gained from the use of the dentiphore may be stated as follows:

(a) From the base or Frankfort plane, changes in vertical positions of teeth can be recorded. In changing the occlusal plane through treatment the oriented cast will show whether this was accomplished by depressing certain teeth, elongating other teeth, or both.

(b) Measuring from the same plane, changes in overbite can be noted.

(c) Changes in the axial position of teeth can be noted from a comparison of the long axis of the teeth with the parallel sides of the cast and their relation to the Frankfort plane.

(d) Mesio-distal movement of the individual teeth or segments of the arch can be ascertained from the preauricular plane.



THE S.S.WHITE DENTAL MFG. CO.
211 S. TWELFTH STREET, PHILADELPHIA, PA.